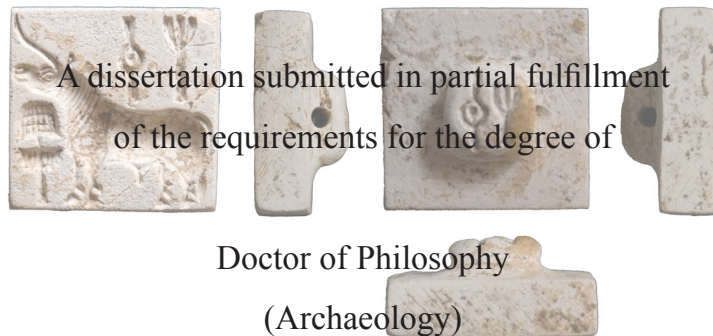


Diversity of Harappan Civilization
: A Case Study of the Ghaggar Basin (with Special Reference to Seals)

by

Ayumu Konasukawa

Under The Guidance Of
Professor **Vasant Shinde**



Doctor of Philosophy
(Archaeology)

at the

Department of Archaeology

DECCAN COLLEGE

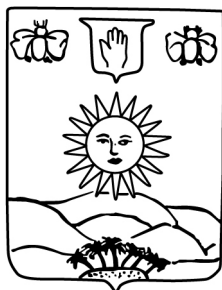
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Certificate

Certified that the work incorporated in this thesis “**Diversity of Harappan Civilization: A Case Study of the Ghaggar Basin (with Special Reference to Seals)**” submitted by Shri. **Ayumu Konasukawa** was carried out by the student under my supervision. Such material as has been obtained from other sources has been duly acknowledged in the dissertation.

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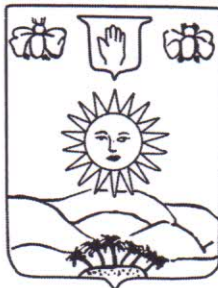
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Abstract

This Ph.D. dissertation discusses the diversity of the Harappan Civilization, especially in the Ghaggar Basin, based on the specialised research of Harappan seals.

The Harappan seals can be divided into two types based on their design, namely Type A seal and Type B seal. Specific features of both types are as follows;

Type A seal: the Harappan seal is characterized by a left-facing animal motif, arrangement Pattern I (i.e. a main motif is engraved in the lower part along with Indus scripts which are depicted in the upper part of the surface) and type I boss (i.e. a boss as a typical example is shaped in symmetry by an incised center line on the square- or bullnose square-shaped boss),

Type B seal: the Harappan seal is characterized by a right-facing animal motif, arrangement Pattern II (i.e. a main motif is engraved in the centre part and Indus scripts are depicted in a space of the surface, not restricted to the upper part of the surface) or III (i.e. only a main motif is engraved without any Indus scripts) and type II boss (i.e. a boss has a simple shape in comparison with Type I and has a just square- or bullnose square-shaped boss without an incised center line) mainly.

As far as the distribution pattern is concerned, although some Type B seals are reported from other regions such as Sindh (e.g. Mohenjodaro), Punjab (e.g. Harappa) and Gujarat (e.g. Dholavira), etc., it is clear from the analysis that Type B seals are

concentrated mainly in the Ghaggar Basin. On the other hand, Type A seals are preferentially distributed in other regions, excluding the Ghaggar Basin.

Furthermore, as the analyses through Scanning Electron Microscope (described as SEM in the present discussion) and 3D (PEAKIT) (will be described in the Chapter 6) images, the sections of the animal's body have a different shape in each seal type, namely Type A seals have a concave section, while on the other hand, Type B seals have a squarish section (some seals have a concave-squarish section). In connection with this point, it can be mentioned that both section types of the animal's body in both seal types are a result of the different manufacture techniques and tools.

The results of this study lead to an important conclusion- that the Harappan seals having a right-facing animal, namely Type B seals, are very likely to show the regional variation or diversity of Harappan seals.

In the centre of the Harappan Civilization, namely the Sindh region, classical Harappan material is associated with the Harappan culture. Examples of the ceramic assemblage likewise comprise mainly of typical Harappan pottery. This situation of the material culture is different from that of the Ghaggar Basin (such as continuity of the Sothi-Siswal ceramic tradition even in the Harappan phase along with the Harappan pottery). In connection with this study, the difference in the Harappan seals is recognized as one of the representative artifacts of the Harappan culture.

According to the special functions and significance of the Harappan seals, it can be pointed out that the seal is the most important indicator of socio-economical aspect of the Harappan Civilization. For this reason, as a main concluding remark of this Ph.D study, it is emphasized that this regional variation or diversity of the Harappan seals reflects a part of diversity of Harappan Civilization, especially in the Ghaggar Basin.

This study therefore emphasizes that the Ghaggar Basin was a crucial region of this Civilization and had a specific feature as part of the diversity of the Harappan Civilization.

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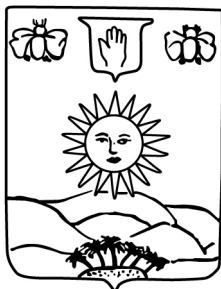
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Chapter 1

Introduction

Chapter 1 - Introduction

Chapter introduction

This chapter will deal with the introduction and aims, research problems, research area and chronology discussed in this thesis, as well as the research method, scheme of chapterization and summary of each chapter, as an introduction of this study.

1. Introduction and Aims

The title of the present Ph.D. dissertation is ‘Diversity of Harappan Civilization: A Case Study of the Ghaggar Basin (with Special Reference to Seals)’. This study aims at understanding the diversity of the Harappan Civilization in the Ghaggar Basin, which formed one of the crucial parts of the Civilization, based on archaeological studies of both Pre-/Early Harappan and Harappan seals.

The discovery of the Harappan Civilization that appeared in the Greater Indus region of Pakistan and northwestern India in the second decade of the early 20th century is considered to be the most significant discovery in the South Asian history mainly because it stretched back the antiquity of the settled life by two thousand years in South Asia, highlighting a period of development, existence, and ultimately the decline of the first urbanized society in the region.

The excavations carried out in 1921-22 at two sites of Harappa and Mohenjodaro (now in Pakistan), have led to the discovery of the Harappan Civilization - i.e. the first civilization in South Asia. At present, more than 1500 sites, including ten or more large city sites, are known to spread over 800,000 square kilometres covering central and south Pakistan and north-western and western India. It was a mere coincidence that both Harappa and Mohenjodaro turned out to be among the largest urban centres of this

civilization. Although the two sites are separated from each other by distance of about 600km, various artifacts such as pottery, beads as well as seals with common shapes, design motifs and manufacturing techniques were found from both the sites (Mackay 1938, 1943; Marshall 1931; Vats 1940, etc.).

The earlier belief that the Harappan Civilization arose out of the spread of civilization from the west (Mode 1961; Piggot 1950; Wheeler 1953, 1966, 1968, etc.) has turned out to be a myth. A number of explorations and excavations in India and Pakistan have thrown enough light on the indigenous development of this civilization (Mughal 1970, 1988, 1990, 1991 etc).

In the meantime, although it is not yet explained sufficiently, the regional variations in the socio-political/economic structures have been pointed out within the Harappan region, which covers a vast area and diverse ecological settings (Sharma 1982; Possehl and Herman 1990, etc.). Therefore it is a necessary task to identify these regional variations in order to understand the diversity of the socio-political and cultural structure of Harappan Civilization, in the context of recent studies in Harappan archaeology.

Some scholars have already pointed out the diversity of the Harappan Civilization, especially on the basis of ceramic typology. For example, in the Ghaggar Basin, regional differences can be observed in the ceramic assemblages of the Harappan sites (such as continuity of the Sothi-Siswal ceramic tradition even in the Harappan phase along with the Harappan pottery), while the sites located in the Sindh - Balochistan region yield classical Harappan elements forming one cultural region which is distinct from the typology of the Ghaggar Basin (will be discussed in Chapter 2).

As far as previous studies of Harappan seals are concerned, they have been also been studied from various viewpoints and methodologies from the beginning of research in Harappan archaeology. These studies include comparative analysis of shapes, motifs and size of the seals, as well as attempts to decipher the Harappan script

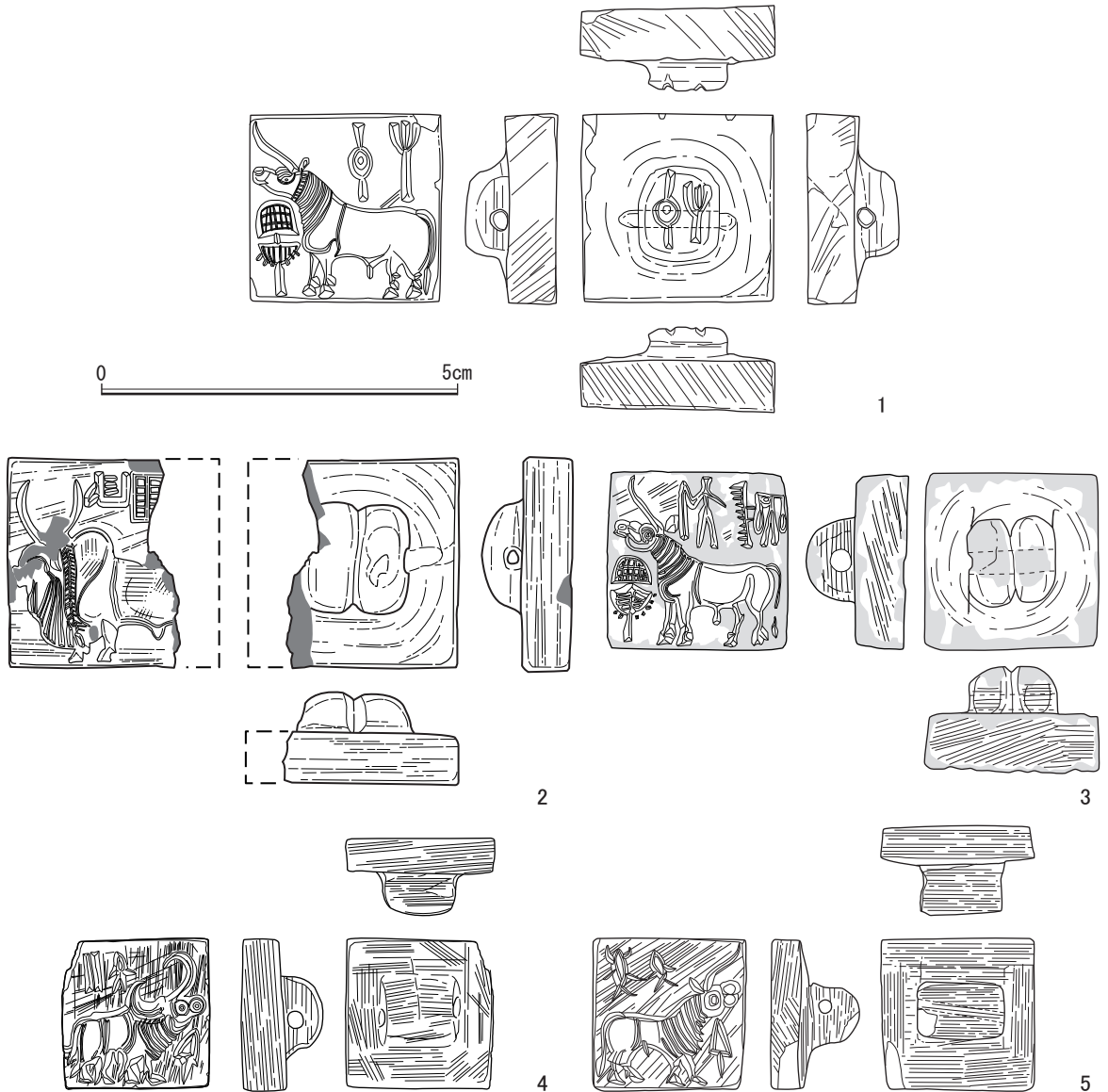


Figure 1.1: Harappan seals discovered from the period II at Farmana (Figure nos. 1, 2, 4 and 5) and stored in Okayama Orient Museum (Figure no. 3) (After Konasukawa 2011a and Shinde et al. 2011; see also photographs and PEAKIT images in Figures 6.20, 21, 27, 31, 35 and 39)

(will be discussed in Chapter 2). But there is no detailed study of Harappan seals in context of the diversity of Harappan Civilization until now. For this reason, the present study focuses on the diversity of Harappan seals, among various other Harappan archaeological artifacts from various sites, as the primary aim of this dissertation.

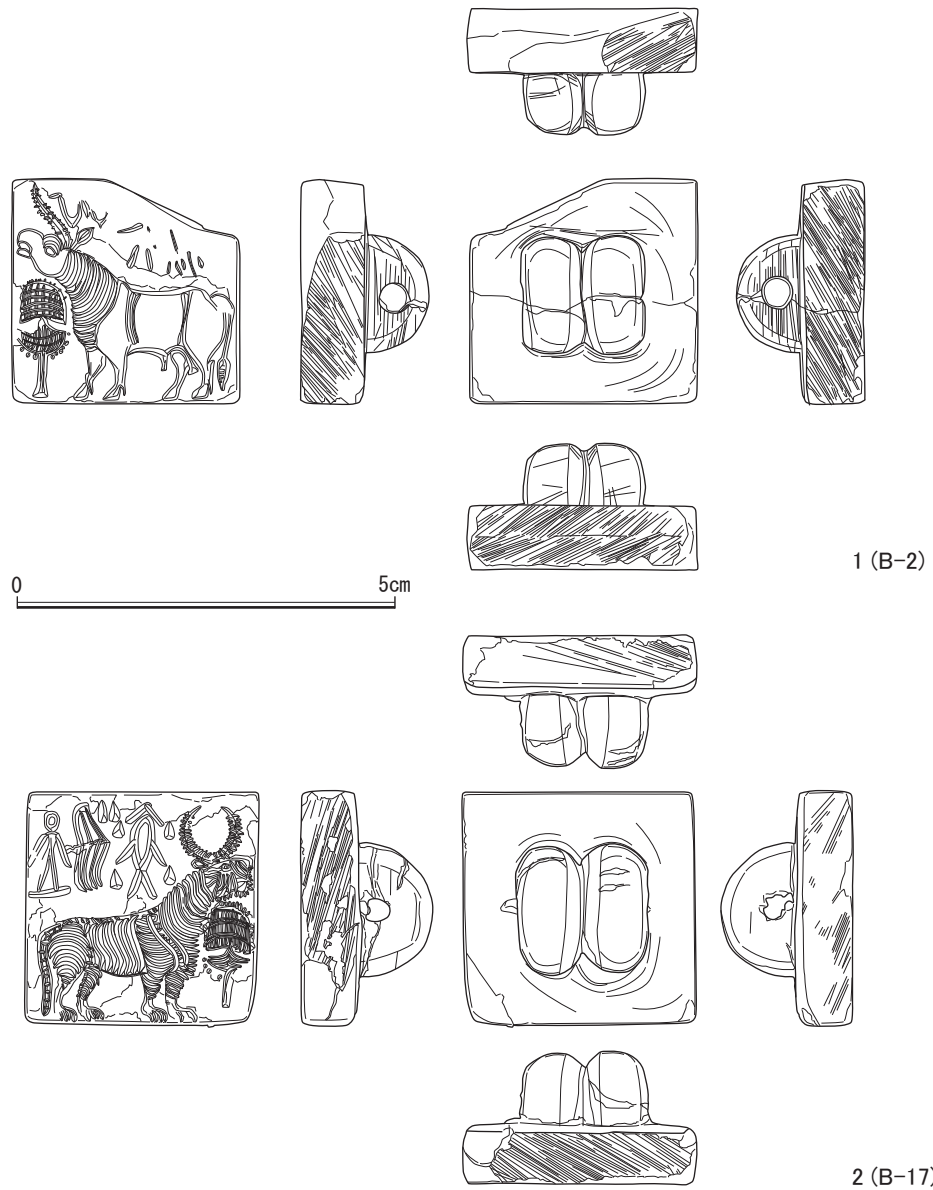


Figure 1.2: Harappan seals discovered from the period II at Banawali (see also photographs and PEAKIT images in Figures 6.45 and 48)

The most distinctive among various categories of Harappan artifacts is the so called Harappan seal, the majority being square in shape, made of fired steatite ⁽¹⁾ (rarely copper or silver) and having boss on the reverse side so that they can be hung from neck or belts. Various motifs of animals (including imaginary or mythological

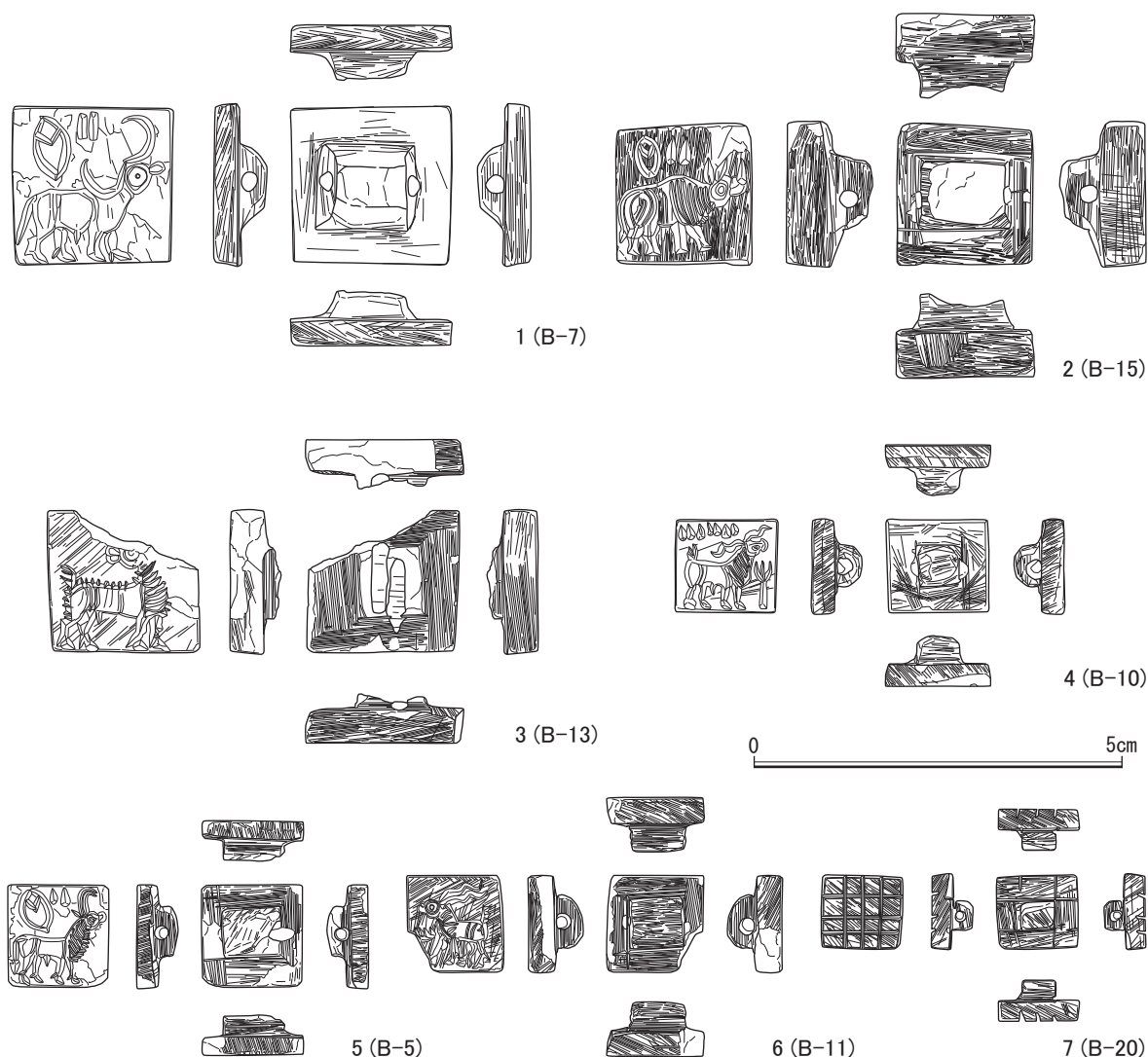


Figure 1.3: Harappan seals discovered from the period II at Banawali (see also photographs and PEAKIT images in Figures 6.52, 55, 57, 61, 65, 69 and 74)

animals such as ‘unicorns’ and horned elephants or tigers, etc.) are engraved on lower portion of the obverse side, along with an average of five Indus characters (or Harappan letters) inscribed on the upper portion (Figures 1.1 to 6). Some of the motifs consists of geometric designs such as concentric circles, cross and swastika, etc. (Figures 1.3-7). Although 86.5% or 1542 out of 1783 seals (total number of seal will be discussed in Chapter 4) concentrate on Mohenjodaro and Harappa as two large urban centres in this

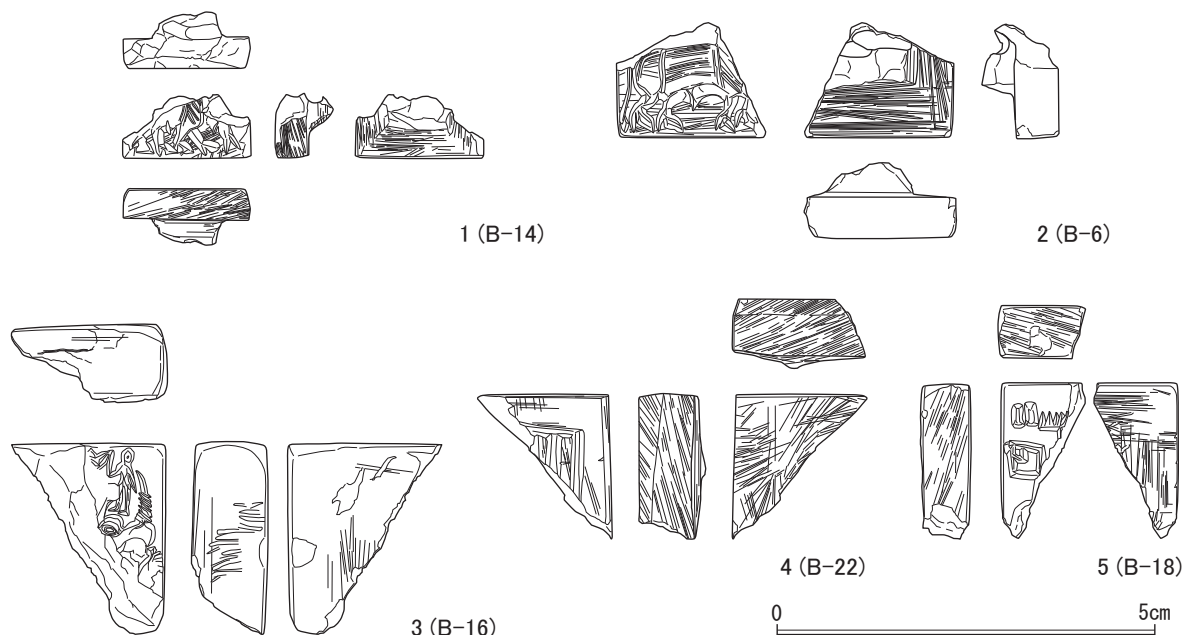


Figure 1.4: Broken pieces of the Harappan seals discovered from the period II at Banawali (see also Figures 1.5 and 1.6, photographs and PEAKIT images in Figure 6.73)

Civilization, a few examples are discovered even at middle or small sized urban centres that are distributed in each region. These are found not only within the geographical extent of Harappan Civilization itself, covering the entire Indus Plain and its surrounding regions, but also from a number of sites in Mesopotamia, the Persian Gulf region, the Iranian Plateau as well as Turkmenistan (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991, etc).

There is no doubt about the prime function of these artifacts as seals, since terracotta sealings with impressions of the seals themselves have been found from various sites (Figures 1.7 and 10). These seals along with the motifs and inscriptions must have served as an ‘ID card’ of their respective owners who must have been merchants or officers who were in charge of trade activities. At the same time, it is also assumed that they were also regarded as amulets, and both the motifs and inscriptions carried certain religious or symbolic meaning.

Given these special functions of Harappan seals, these artifacts were



Figure 1.4-1 (250%)



Figure 1.4-3 (200%)

Figure 1.5: Broken pieces of the Harappan seals discovered from the period II at Banawali (see also Figure 1.4)



Figure 1.4-4 (200%)

1



Figure 1.4-5 (200%)

2

Figure 1.6: Broken pieces of the Harappan seals discovered from the period II at Banawali (see also Figure 1.4)

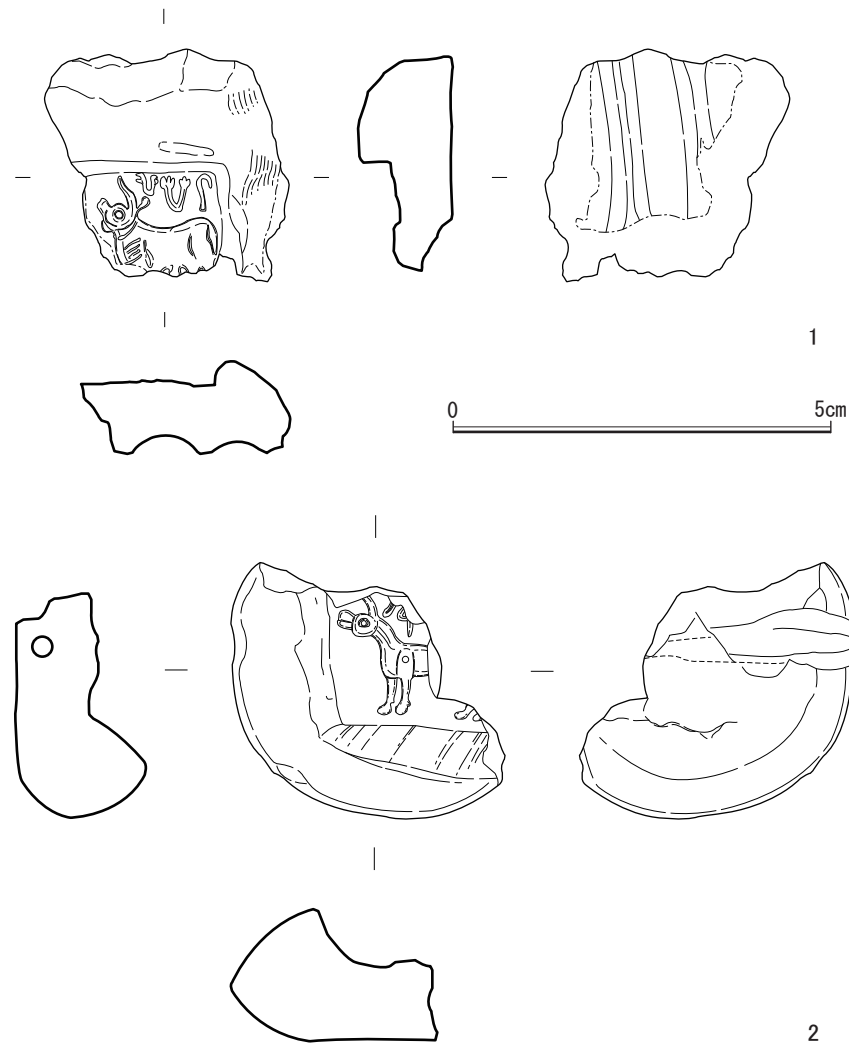


Figure 1.7: Harappan sealings discovered from the period II at Farmana (After Shinde et al. 2011; see also Figure 1.8)

selected as the main research material of this study. It can be pointed out here that Harappan seals are the most important indicator of the structure of the socio-economical aspect of the Harappan Civilization because of their significance and functions. For this reason, it is emphasized that the detailed study of Harappan seals will yield important clues for a better understanding of the diversity of the Harappan Civilization.

2. Research problems

The present Ph. D. work had been undertaken on the seals of Pre-/Early and



Figure 1.7-1 (200%)



1



Figure 1.7-2 (200%)



2

Figure 1.8: Harappan sealings discovered from the period II at Farmana (After Shinde et al. 2011; see also Figure 1.7)

Mature Harappan periods in the Ghaggar Basin, mainly with a view to studying the aspects highlighted below, which have not been dealt with in great detail by previous scholars in the field.

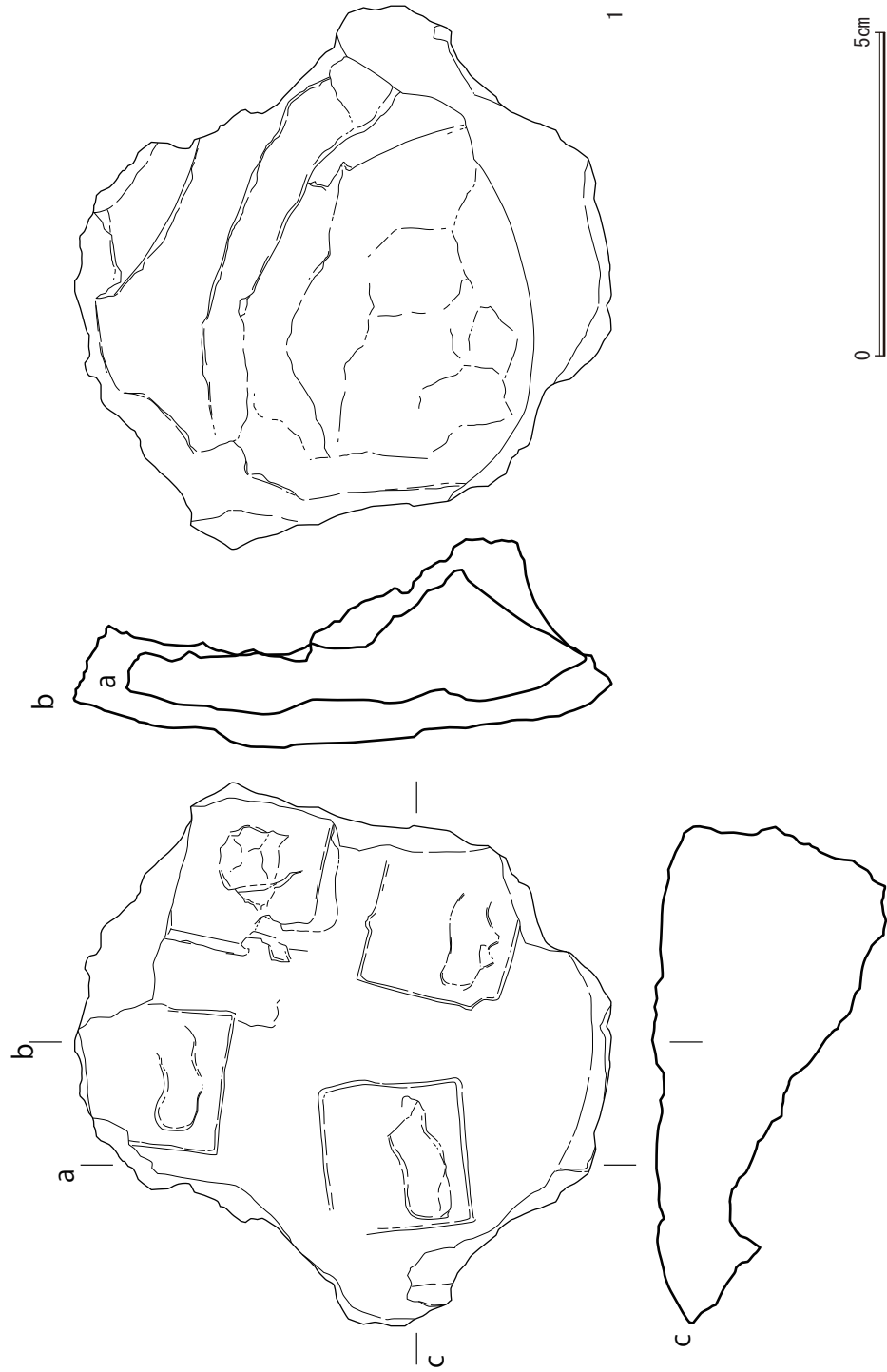


Figure 1.9: A Harappan sealing discovered from the period II at Farmana (see also Figure 1.10)



Figure 1.9-1 (100%)

Figure 1.10: A Harappan sealing discovered from the period II at Farmana (see also Figure 1.9)

1) To understand the kind of seals used during the Pre-/Early Harappan period.

In recent excavations, many seals and sealings are reported from various sites in the Pre-/Early Harappan period. Whereas those seals and sealings have been identified, the typology of the seals that had been used in the Pre-/Early Harappan period is not yet understood. The present study aims at studying various aspects of the Pre-/Early Harappan seals (i.e. motif, shape, size and distribution pattern, etc.) and the contribution of the Pre-/Early Harappan seals to the development of later forms of Harappan seals (will be discussed in Chapter 3).

2) To understand various aspects and diversity or regional variation of Harappan seals.

The Ph. D. work aims at studying various aspects of Harappan seals as the main research material (i.e. motif, shape, size, arrangement pattern, distribution pattern and manufacture techniques, etc.) in order to understand the diversity or regional variation of Harappan seals (will be discussed in Chapters 4 to 6). The main method of the present study on the seals is comparative, statistical and scientific analyses (i.e. SEM and 3D analysis).

3) To understand diversity of Harappan Civilization

The earlier belief that the Harappan Civilization was homogenous through space and time has turned out to be a myth. A number of cultural manifestations have been found within the greater complex of the Harappan Culture, which reflect local variations of cultural traditions in each region. This Ph. D. work aims at studying this diversity of Harappan Civilization through the detailed discussions and analyses of the seals discovered in the Ghaggar Basin (will be discussed in Chapter 7).

3. Research area and chronology discussed in this thesis

3-I. Research area

Although research areas of this work should ideally cover a number of sites

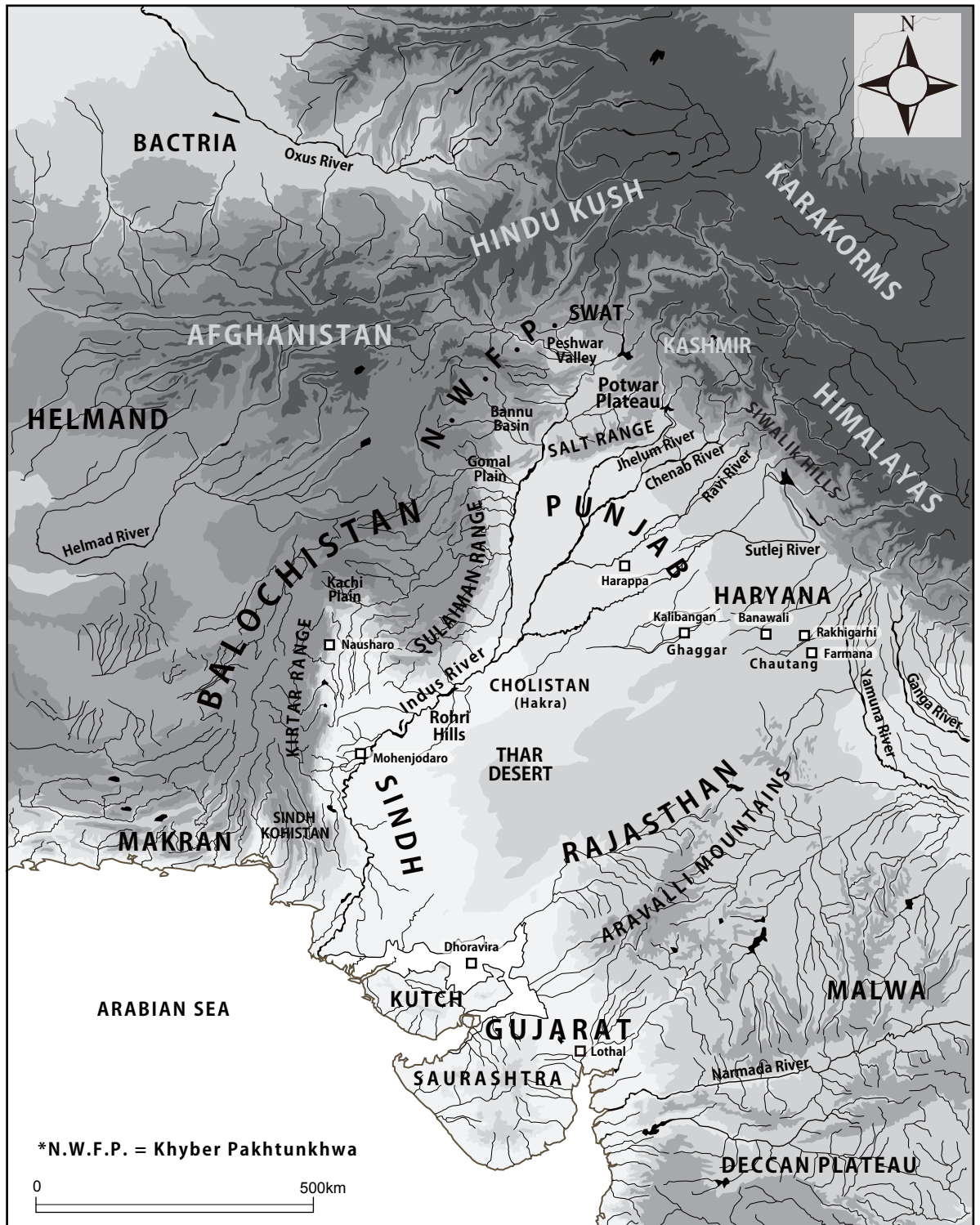


Figure 1.11: Sites and regions discussed in the present study

in both India and Pakistan, the focus will be on the Ghaggar Basin, which lies in the present states of Punjab, Haryana and Rajasthan in India (Figure 1.11). These parts of the Ghaggar Basin fall in a subtropical, semi-arid to sub-humid, continental and monsoonal type of climate. The geological formation in the state of Haryana ranges from the pre-Cambrian to the recent times and can be divided into the Aravalli system, the Siwalik system and the alluvial plains. The alluvium effectively conceals the solid geology of the floor. The Chautang and Ghaggar Rivers had occasionally shifted their beds in the Holocene times leaving interlocked alluvial plains along its receding course. The thickness of the alluvium varies from 100 m to more than 400 m at places. The main physiographic units in this area are the Chautang Flood plains and Aeolian plains. The Ghaggar and Chautang Rivers, though now dry, were both important for the human occupation through its history, mostly during the Pre-/Early and Mature Harappan periods as surveys in this region have revealed a heavy concentration of sites from those periods. The Ghaggar-Hakra River ('Hakra' is a name given to the same river in Pakistan) has been identified as the ancient Saraswati (Sarasvati) and the Chautang as Drishadvati which are very often referred to in the Rig Veda.

Many well-known archaeological sites like Banawali (Bisht 1993, 1999, etc), Bhirrana (Rao et al. 2004, 2005, 2006), Baror (Sant et al. 2005), Farmana (Shinde et al. 2011), Girawad (Shinde et al. 2011), Kalibangan (Lal et al. 2003), Kunal (Acharya 2008; Khatri and Acharya 1995), Mitathal (Suraj Bhan 1975 etc.), Rakhigarhi (Nath 1998, 1999), Tarkhanewala Dhera (Trivedi 2009), Siswal (Dikshit 1984; Suraj Bhan 1971-72), Sothi (Dikshit 1984) and Nohar (Dikshit 1984) etc. have been systematically excavated and studied in the Ghaggar Basin. Most of these sites have a cultural sequence ranging from the Pre-/Early to the Late Harappan period (c. 3500-1400 BC). This cultural sequence reflects a long history of human occupation, which may reveal the development of regional cultures and their relations with the Harappan Civilization, and the importance of the Ghaggar Basin in studying the diversity of the Harappan

Table 1.1: Chronology of Harappan Tradition in Pakistan and northwestern India (see also Appendices 1.1 to 4)

	Mesopotamia	Balochistan	Sindh	Western Punjab	Ghaggar-Chautang	Gujarat
1800BCE		Mhr VIII	Jhukar, Amr IIID	Hrp 5		
1900BCE	Ishin-Larsa				Bnl III, Mtl IIB	Dlv VI
2000BCE		Nsh IV				Ltl B
	Ur III		Mjd B, Amr IIIC (upper layer)	Hrp 3C		Dlv V
2200BCE	Akkad				Mtl IIA	
						Dlv IV
2350BCE	ED IIIB					
2450BCE	ED IIIA	Nsh III	Mjd B, Amr IIIB	Hrp 3B		Dlv III, Ltl A
2500BCE	ED II				Mtl I	
2600BCE	ED I	Nsh II Nsh ID Mhr VIIC, Nsh IC	Mjd A, Amr IIIA Cfd Ia Amr ID/IIA/IIB	Hrp 3A Hrp 2	Klb II, Bnl II, Frn II	Dlv II
		Mhr VII B, Nsh IB			KnI IC	
2800BCE		Mhr VII A, Nsh IA		Hrp 1B	Klb I, Bnl I KnI IB	Dlv I
		Mhr VI				
3000BCE	Jemdet Nasr	Mhr V	Amr IC			
				Hrp 1A	KnI IA	

ED = Early Dynastic Mhr = Mehrgarh Nsh = Nausharo Amr = Amri Cfd = Chunfudaro Mjd = Mohenjodaro Hrp = Harappa
KnI = Kunal Klb = Kalibangan Bnl = Banawali Frn = Farmana Mtl = Mithatal Ltl = Lothal Dlv = Dholavira

Civilization.

3-II. Chronology

This study will primarily deal with two periods of the Harappan Civilisation, namely Pre-/Early Harappan period (c. 3000-2600 BCE) and Mature Harappan period (c. 2600-1900 BCE) (Table 1.1). The detailed chronology of the Harappan tradition and its neighbors is described in Appendix (see also Appendices 1.1 to 4). These chronological charts, which are used in the present study, are basically based on the results of various scholars (Dales 1965, 1973; Franke-Vogt 2008a; Kamada 2000; Kenoyer 1991b; Possehl

1989, 1993, 1999; Possehl and Rissman 1992; Quivron 2000; Shaffer 1992, etc.).

According to C14 dating in Harappa (Meadow and Kenoyer 2005 etc.), the Mature Harappan period is divided into three periods, namely Period 3A: Harappa A (c. 2600/2500-2450/2400 BC), Period 3B: Harappa B (c. 2450/2400-2200 BC) and Period 3C: Harappa C (c. 2200-1900 BC).

Chronological comparison and typological variation of the seals should also be taken into consideration, but unfortunately, precise data is not yet available in sufficient quantities.

For this reason, this study is based on the general chronology (i.e. Pre-/Early Harappan and Mature Harappan periods).

4. Research method

The main method of this study is comparative, statistical and scientific analyses (i.e. SEM and 3D analysis) of the Pre-/Early Harappan and Harappan seals from various sites in the Ghaggar Basin, especially Farmana, Banawali and Kunal. The following works have been conducted in order to collect data and complete the analyses of this study.

- 1) Participation in excavations at Farmana to understand the nature of archaeological data that associated with the Pre-/Early and Mature Harappan periods firsthand. A detailed preliminary analysis of the seals had been undertaken on the field itself.
- 2) To undertake a systematic, comparative, statistical analysis and a study on the Pre-/Early Harappan and Harappan seals collected from various excavated sites. A number of Institutions such as the Department of Archaeology and Museums, Haryana (Haryana, Panchkula) and Shri Krishna Museum (Kurukshetra, Haryana), etc. were visited in order to study the relevant material stored in their repositories.
- 3) To undertake a scientific analyses (i.e. SEM and 3D analysis) on the Pre-/Early Harappan and Harappan seals. The seals were observed through SEM and 3D images

for better understanding of the manufacture techniques in a full sense.

4) To systematically collect published data on Harappan Civilization in general and the Ghaggar Basin in particular. Numerous articles and excavation reports had been published so far, and these form a frame of reference for the present study.

5. Scheme of chapterization and summary of each chapter

This Ph.D. dissertation constitutes seven chapters, excluding some parts such as the Table of contents, Abstract, List of figures and tables, Acknowledgements, Appendices and Bibliography. In this section, the scheme of chapterization and summary of each chapter will be discussed as follows.

Chapter 1 - Introduction:

This chapter will deal with the introduction and aims, research problems, research area and chronology as discussed in this thesis, as well as the research methodology, scheme of chapterization and summary of each chapter as an introduction to this study. Details of the same are already mentioned above.

Chapter 2 - Previous Research on Diversity of the Harappan Civilization and Harappan seals:

In chapter 2, previous research on the diversity of the Harappan Civilization and Harappan seals are summarized, in order to explain and justify the selection of the Harappan seals as the main research object, among various categories of Harappan artifacts, for understanding the diversity of Harappan Civilization.

Chapter 3 - The Seals of in Pre-/Early Harappan Period in light of the Seals in the Ghaggar Basin:

Chapter 3 discusses the seals in the Pre-/Early Harappan period in light of the Seals of the Ghaggar Basin in order to understand the kind of seals that had been used in the Pre-/Early Harappan period in this region, and their significance. It is important in the course of this study to understand the nature of the immediate predecessors of the

Harappan seals for this study.

Through the analysis of this chapter, it has become evident that Pre-/Early Harappan seals consist of stamp-type seals and button-type seals characterized by common motifs such as geometric designs or concentric circles, and that among these, steatite seals are concentrated specifically in the northern area, including the regions of Gomal, Punjab, and Ghaggar Basin.

Furthermore, in order to consider the significance of these seals, their distribution is compared with that of specific pottery types (i.e. Kot Diji Pottery, Sothi-Siswal Pottery and Quetta Pottery including Faiz Mohammad Ware) and the functions of Harappan seals. This chapter concludes that before the Harappan seal was invented, in the formative period of the Mature Harappan period, there was a functioning system that controlled the flow of merchants, goods, and much information in the northern area where seals with such motifs were used, and a cultural exchange that operated over a wider area than regions united by a specific pottery type.

Chapter 4 - Harappan seals and their Significance:

In chapter 4, the details of Harappan seals as a main research material of this study and their significance through the analysis of motifs and size category are discussed.

The Harappan seals can be divided into three types based on their shape and style of depicting motifs and scripts:

- (I) square seals having boss on reverse,
- (II) square seals having motifs and script inscribed on both obverse and reverse and thus having no boss,
- (III) oblong seals having convex shaped cross section with a hole pierced across its section, instead of carving out separate boss. Only characters are inscribed on obverse without any other motifs.

This study basically focuses only on type (I) seals, since this type makes up the

largest number of seals excavated from many sites in various regions.

For the analysis, these square type seals are first classified based on the motifs and secondarily by size measurements (lengthwise and crosswise). The size measurements are simply taken by measuring photographs of each seal published in the three volumes of the *Corpus of the Indus Seals and Inscriptions* (hereafter abbreviated as *the CISI*) edited by J.P. Joshi and A. Parpola (Vol.1, 1987), by S.G.M. Shah and Parpola (Vol.2, 1991) and by Parpola, B.M. Pande and P. Koskikallio (Vol.3, 2010) and so on. In this study, only the seals found within the territory of Harappan Civilization are considered for analysis.

The number of seals from these three volumes where motifs could be identified amounts to 1740 seals, with an additional 43 seals from the more recent excavations, so far unpublished in *the CISI*. This amounts to a total of 1783 seals for analyses in this study, out of which 1597 seals could be measured. Measurements were recorded in millimeters, rounded to the nearest tenths. Based on scatter plots of these measurements, the seals were classified into various size categories (i.e. categories A to E). Thickness of seals is also an important factor for analysis, but unfortunately no photographs of lateral sides are shown in *the CISI*, and no such data could be collected. There are about 51 unfinished and 169 broken seals recorded in *the CISI* and other reports, but these are omitted from the present analysis. In addition, in the course of discussions on the direction of an animal motif depicted on the seals, seals having non-animal motifs (i.e. geometrical one etc.) are excluded altogether.

It is clear from the analysis in this chapter that the motifs on Harappan seals can be classified into the following categories and sub-categories. Firstly, they are categorized based on the number of objects depicted, either singularly or in groups, and secondly, either real or imaginary beings (each motifs are discussed in a full sense in Chapter 4).

It is also clear from this analysis that Harappan seals were made, though not so

rigidly regulated, on certain size categorization of their respective motifs (categories A to E). The majority of seals fall between around 17-35 mm and each group has at least two categories - large and small - which clearly indicate that there was a hierarchy among them. Even the geometric seals have large and small categories though their size distribution is unique.

The largest seals, exceeding 45 mm, are confined to the unicorn and zebu seals found from two large urban sites of Mohenjodaro and Harappa (with one exception from Chanhudaro), owned by person in charge.

Furthermore this analysis points out that the seals having a right-facing animal motif, discovered mainly from the Ghaggar Basin, show regional variations of Harappan seals, which will be elaborated upon in the following Chapters.

Chapter 5 - Design of the Harappan Seals: Consideration of the Harappan Seals Having Right-facing Animal Motif:

Chapter 5 deals with the design of Harappan seals through some aspects such as motifs, Harappan scripts, arrangement pattern of motifs, type of boss, size and distribution pattern to understand the significance of Harappan seals having a right-facing animal motif.

The patterns of motif arrangement of Harappan seals indicate a specific rule about the arrangement pattern of a main motif and the script that is engraved on the surface of the seals. The motif arrangement patterns are classified into three patterns as follows,

Pattern I: a main motif is engraved in the lower part along with Harappan script which are depicted on the upper part of the surface,

Pattern II: a main motif is engraved in the centre part and Harappan script engraved on some part of the surface, not necessarily restricted to the upper part,

Pattern III: only a main motif is engraved without Harappan characters.

The bosses of the seals can be broadly divided into two types as follows,

Type I: a boss as a typical example is shaped in symmetry by incised center line on the square- or bullnose square-shaped boss,

Type II: a boss has a simple shape comparison with Type I and has a just square- or bullnose square- shaped boss without an incised center line.

Assuming the design depicted on the surface of Harappan seals is not just an aggregate of the motifs but arranged under a secure rule, we can grasp a standard of design or a rule for arranging each motif. The arrangement pattern of the motifs is analysed here again to understand a rule for arranging each motif. It is clearly that 95.7% or 1388 out of a total of 1451 seals (this total number is the number of seals having an accurate arrangement pattern of motifs, namely patterns I, II and III) is expressed as Pattern I. As is indicated by this analysis, it has to be noted that a basic rule of motif arrangement pattern is very strict. In connection to this point, it should be noted that Pattern I is basically expressed along with a left-facing animal as a main motif and a Type I boss. In conclusion, it is interesting to note that a rule of design of Harappan seals is based on 'motifs consisting of a left-facing animal and Harappan scripts, etc. are arranged by Pattern I with a Type I boss'. The present work highlights this strict rule as an intentional design of Harappan seals, and will refer to the seal designed by this rule as 'Type A seal' in this study.

In the light of recent excavations, however, another type of Harappan seal has been reported. This type is characterized by a right-facing animal as a main motif engraved on the surface instead of a left-facing animal. There are 74 seals having a right-facing animal.

As is discussed in this chapter, it is noteworthy that Harappan seals having a right-facing animal have some different features from Type A seals. Those differences are confirmed on the basis of some aspects such as motifs, Harappan scripts, type of boss and distribution pattern. As far as distribution pattern is concerned, it is clear from the present analysis that the seals having a right-facing animal are concentrated in the

Ghaggar Basin. In connection with this point, it can be pointed out that the majority of the seals having a right-facing animal are characterized by Pattern II and high percentage of sharing common Harappan script characters. Furthermore, as mentioned above, it is also emphasized that these seals have a Type II boss mainly, not a Type I boss.

The results of this chapter lead to an important conclusion that the seals having a right-facing animal are very likely to show regional variation or diversity among Harappan seals, which has not been pointed out so far. Concerning the high percentage of common script characters within the seals having a right-facing animal, which are discovered in the Ghaggar Basin, it is important to note that these seals had functioned on a different rule of design in comparison to Type A seals, and will henceforth be designated as 'Type B seal' for the purpose of this study.

Chapter 6 - Comparative analysis of the seals in the Pre-/Early Harappan period and Harappan Seals through SEM and 3D images:

In chapter 6, manufacture techniques of the seals are analysed with the help of SEM and 3D images, in order to understand the differences and sequence of carving techniques of the Pre-/Early Harappan and Harappan seals, and differences of carving techniques among the Harappan seals (i.e Type A and Type B seals).

SEM and 3D images show various evidences of manufacture techniques of the seals. As is indicated by the analysis in this chapter, it can be pointed out that a part of carving techniques of the Pre-/Early Harappan seals were passed on to those of Mature Harappan seals and almost the same carving techniques are observed between the convex type seal and the typical Harappan seals.

It is also clear that the shape of the section (i.e. concave section, squarish section or concave-squarish section) and the carving technique of the body part of animal motifs which are depicted on the seals give an important clue to understanding the regional variations of carving techniques among Harappan seals. As a conclusion, it is

worthwhile to note that the animal motifs of Type A seals (which are characterized by a left-facing animal) basically have concave sections on the animal's body. On the other hand, the bodies of animal motifs in Type B seals (which are characterized by a right-facing animal) basically have a squarish or concave-squarish section.

In connection with this point, observations through SEM and 3D images show that concave sections, squarish sections and concave-squarish sections of the animal motif are based on the different manufacture techniques and tools. It may also be possible that the different manufacture techniques and tools of those types are understood as indicators in order to understand different manufacturing areas of each type of seal.

The results of this chapter also lead to an important conclusion- that the seals having a right-facing animal, namely Type B seals, are very likely to show regional variation or diversity of Harappan seals, that has been hitherto unobserved.

Chapter 7 - Discussions and Conclusions:

In the last chapter, the diversity of the Harappan Civilization based on the various discussions of Harappan seals in this dissertation are discussed, and conclusions drawn as to the results of this study.

As is indicated by analyses in the course of this study, Harappan seals can be divided into two types based on their design, namely Type A seal and Type B seal. Type A seals are characterized by left-facing animal motif, arrangement Pattern I and Type I boss. On the other hand, Type B seals are characterized by right-facing animal motif, arrangement Pattern II or III and type II boss.

As far as distribution pattern is concerned, although some Type B seals are reported from other regions such as Sindh (e.g. Mohenjodaro), Punjab (e.g. Harappa) and Gujarat (e.g. Dholavira), etc., it is clear from above analysis that Type B seals are mainly concentrated in the Ghaggar Basin.

Additionally, as per the results of SEM and 3D imaging, the section of the

animal's body depicted on both seal types have different shapes, namely Type A seals have concave section, on the other hand, Type B seals have squarish section or concave-squarish section. Likewise, it can be pointed out here that both section types of the body are caused by the different manufacture techniques and tools.

It can be presumed that Type B seals which are reported from Sindh, Punjab and Gujarat, etc. were transported from the Ghaggar basin to those regions, while on the other hand, Type A seals reported from the Ghaggar basin came from Sindh (Mohenjodaro) and Punjab (Harappa).

The results of this study show that the seals having a right-facing animal, namely Type B seals, are very likely representatives of a regional variation or diversity in the typical Harappan seals that is seen in the Ghaggar Basin.

According to the special functions and significance of Harappan seals, it can be pointed out that the Harappan seal is the most important indicator of its respective Civilization. For this reason, as an important conclusion to this study, it is emphasized that this regional variation or diversity of Harappan seals, as well as regional differences in the ceramic assemblages of the Harappan sites (such as continuity of the Sothi-Siswal ceramic tradition even in the Harappan phase along with the Harappan pottery), reflects a part of diversity of Harappan Civilization, especially in the Ghaggar Basin.

As is indicated by the conclusion in this study, it is most likely that the structure of the Harappan Civilization involves social/cultural diversity.

Note

1) The steatite is understood as the sedimentary rock, which is made up in the neritic sediment unit, especially the limestone unit, of the period ranging from the end of Mesozoic era (i.e. Cretaceous period) to the old Tertiary period in the geological timeline. The steatite can be acquired in the area ranging from the Kirtar Range to the Sulaiman Range on the right bank of lower Indus river and the area alongside the Salt Range. On the other hand, in the area south of the Salt Range on the left bank of Indus river, it is difficult to acquire the steatite at the area excluding the regions ranging from the Rohri hills to the hills in Thar. According to R.W. Law's study (Law 2008), the steatite discovered at the site of Harappa were not carried from various regions at random, it is pointed out that they are limited to the steatite which is yielded from the Hazara region or the Khyber Agency.

Chapter 2

Previous Research on Diversity of Harappan Civilization and Harappan seals

Chapter 2 - Previous Research on Diversity of Harappan Civilization and Harappan seals

Chapter introduction

Chapter 2 summarises previous research on the diversity of Harappan Civilization and Harappan seals in order to justify the selection of the Ph.D. aims, and the identification of Harappan seals as the primary subject of study- among the various categories of Harappan artifacts- in the course of this work.

1. History of research on the diversity of Harappan Civilization

Scholars have pointed out that the Harappan Civilization was not homogenous through space and time, based on data from recent excavations and explorations.

The representative theories of the diversity of Harappan Civilization are ‘Sorath-Harappan’ culture (Possehl and Herman 1990) and ‘domain’ theory (Possehl 1999, 2002) by G.L. Possehl. The first scholar to point out this distinction within the Harappan Civilization was J.P. Joshi (Joshi 1984). However, Possehl has identified more than 7 domains (i.e. Harappan Domain, Eastern Domain, Cholistan Domain, Sindhi Domain, Kulli Domain, Sorath Domain, Northwestern Borderlands and Anarta Chalcolithic) on account of geography, settlement pattern data and cultural material (Possehl 2002, 2003). The excavations at Rojdi by Possehl and Raval (Possehl and Raval 1989) were important from the point of view of identifying the regional variations of the Harappan Civilization in Saurashtra. It was noticed that the material culture associated with the Harappan culture at Rojdi showed some differences when compared to material found in the Sindh-Baluchistan region, termed by Possehl as the ‘Sindhi Harappan’ Domain. This was found to be true for the entire Saurashtra region. This difference was treated

as a regional variation of the Harappan culture in Saurashtra and termed as ‘Sorath Harappan’ (Possehl and Herman 1990). Similar regional differences in the material culture are visible, particularly in the ceramic assemblages of the Harappan sites in the Saraswati basin while the sites located in the Sindh-Baluchistan region have classical Harappan elements and thereby form one distinct region within the Harappan empire. Although it is impossible to identify the existence of regional societies or cultures such as Sorath Harappan culture in other regions under present condition because of a lack of sufficient data of excavation and exploration, it is important to note – as Possehl points out- the possibility of the existence of diversity within the Harappan Civilization and regional cultural traditions of each region.

There are some studies about diversity of Harappan Civilization that precede Possehl’s study. Y.D. Sharma evaluated that the Bala culture of eastern Punjab continued from the Pre-/Early Harappan period to the Post Harappan period (Sharma 1982). Sharma’s study suggests that the diversity of Harappan Civilization resulted from the regional cultural traditions in the Pre-/Early Harappan period.

Although the relationship of regional cultures and the Harappan Civilization have not been discussed sufficiently, these studies indicate that the earlier belief of the Harappan Civilization being homogenous throughout space and time was incorrect.

Recent advances in Harappan archaeology, (based on the studies of ceramic assemblages), have revealed the presence of a number of cultural manifestations that reflect regional variations of cultural tradition within the whole Harappan region.

For example, in the Ghaggar Basin, regional differences can be observed in the material culture - particularly in the ceramic assemblages of the Harappan sites like Farmana etc., which show a continuity of the Sothi-Siswal ceramic tradition even in the Harappan phase, along with the typical Harappan pottery (Shinde et al. 2011 etc.), while the sites located in the Sindh-Balochistan region yield classical Harappan elements forming one cultural region (such as the substitution of Pre-/Early Harappan elements at

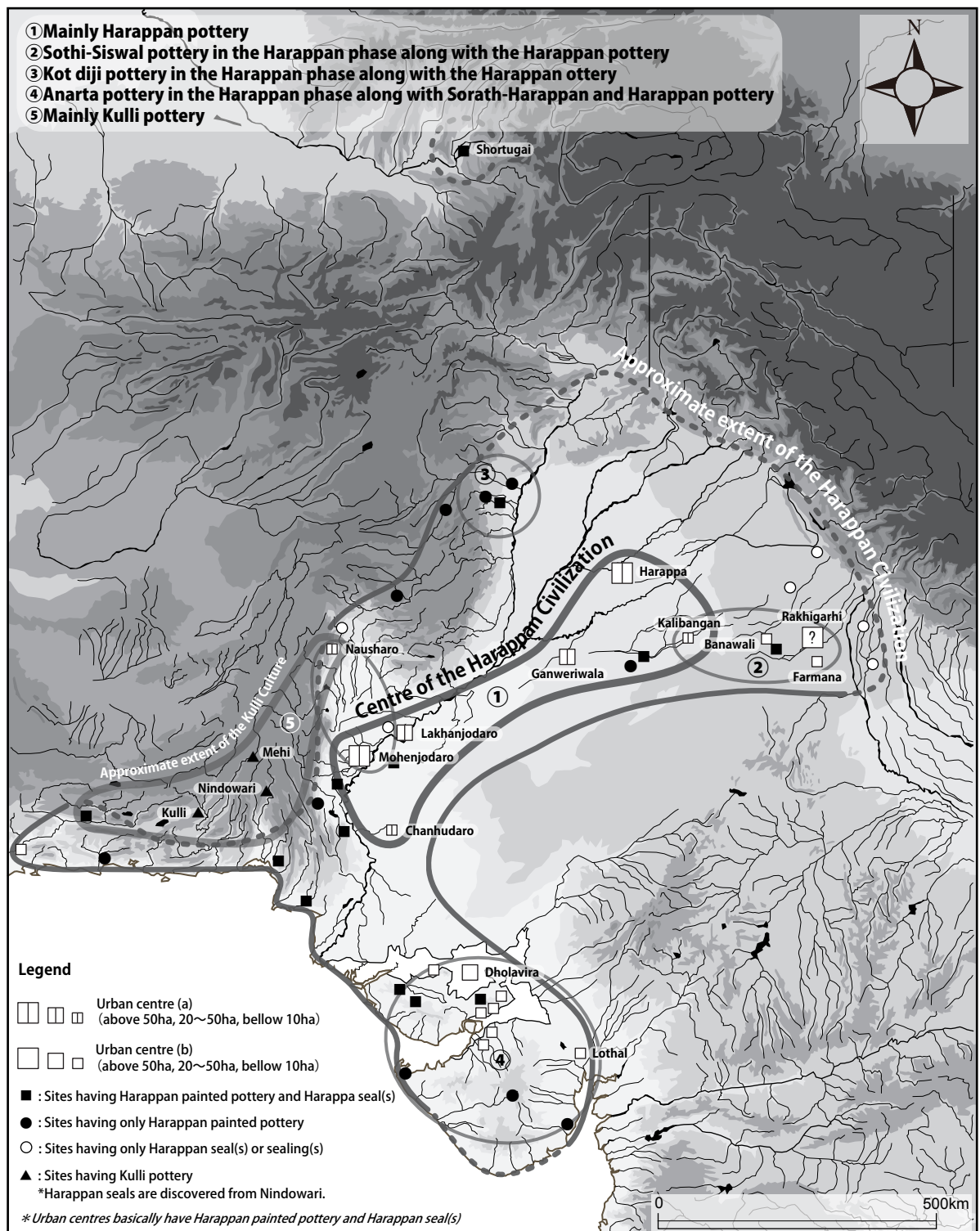


Figure 2.1: Regional variations of the ceramic assemblages in Harappan Civilization

sites like Kot Diji by the assemblages of the Harappan culture in that expanse) which is distinct from the scenario in the Ghaggar Basin (Figure 2.1).

The same situation is observed in the Gomal and Gujarat regions. In the Gomal region the Kot Diji ceramic tradition continued even in the Harappan phase along with the Harappan pottery (Dani 1970-71; Konasukawa 2008c), and in the Gujarat region the Anarta ceramic tradition continued into the Harappan phase along with the Harappan and Sorath-Harappan pottery (Ajithprasad 2002; Kharakwal et al. 2012; Shinde 1992, 1998; Sonawane and Ajithprasad 1994, etc.) (Figure 2.1). Furthermore, in the southern Balochistan region, the Kulli ceramic tradition - which could have originated from the Balochistan ceramic tradition (i.e. Quetta style pottery etc.) with noticeable differences from Harappan pottery - had been used during the Mature Harappan period (Casal 1966; Jarrige et al. 2011; Kondo et al. 2007; Possehl 1986; Quivron 2008; Shudai 2009-2010, Shudai et al 2009, 2013) (Figure 2.1).

Based on this evidence, it seems likely that the regional cultures before the Mature Harappan phase contributed to the development of the Harappan elements in each of these regions, since a number of regional Pre-/Early Harappan cultures flourished in various parts of the Harappan region. In due course, the relationship between these regional cultures and the Harappan culture that succeeded them generated the regional variations or diversity in the Harappan Civilization.

2. Research history on Harappan seals

The Harappan seals have been studied from various viewpoints and approaches since the beginning of archaeological studies on Harappan Civilization.

These studies include comparative analysis of shapes, motifs and size of the seals (Atre 1985, 1985-86, 1987, 1990, 1998; Fairservis 1986; Franke 1984; Franke-Vogt 1991, 1992; Frenze and Vidale 2012; Gadd 1933; Koiso 2002, 2005; Koiso and Konasukawa 2009; Konasukawa 2007, 2011a, 2011b; Kondo 2006; Mackay 1931;

Noguchi 2003; Parpola 1986, 2011a, 2011b; Parpola and Janhunen 2011; Rissman 1988, 1989, etc), as well as attempts to decipher the Indus script (Farmer et al. 2004; Mahadevan 1977; Parpola 1994b; Possehl 1996; Rao 1982; Zide and Zvelebil 1976, etc.)⁽¹⁾.

There are three volumes of the corpus of Harappan seal and inscriptions, namely the Corpus of Indus Seals and Inscriptions (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991).

In recent studies, although it is still in the formative period of research, some scholars have discussed manufacture techniques of Harappan seals through SEM and 3D analyses (Green 2011; Konasukawa 2012a, 2012c; Kenoyer and Meadow 2011, etc), based on the early studies by E.J.H. Mackay (Mackay 1931).

In the connection with the studies of Harappan seals, it can be said that the studies of Dilmun seals (Al-Sindi 1999; Bruswing et al. 1983, Kjaerum 1983, 1994 etc.), Persian Gulf seals (Hallo and Buchanan 1965; Mitchell 1986, etc.) and the seals of BMAC (Bactria Margiana Archaeological Complex) (Hiebert 1994; Parpola 2005; Salvatori 2000; Shinde et al. 2005; Winckelmann 2000, 2005, etc.) are also very important. For this reason, future work by the author will consider the relationships of Harappan seals with those seal types following the completion of this Ph. D. study.

3. Chapter conclusion

Studies of the various ceramic assemblages within the Harappan Culture have shown a number of cultural manifestations which reflect regional variations of cultural tradition (Figure 2.1). Likewise, there are many previous studies on Harappan seals conducted from various view points.

However, no studies on Harappan seals till date have considered the possibility of regional variations and diversity in Harappan Culture being reflected in the seals found from different regional zones. For this reason, the present study focuses on

Chapter 2

variations in Harappan seals and their connection to regional diversity in the greater complex of the Harappan culture.

Note

1) The Study of Harappan seals is very important for understanding the structure of the urbanized society of Harappan Civilization, especially the trade and exchange activities. The roles of the trade and exchange activities in the Greater Indus region or between the Greater Indus region and neighboring zones during the 3rd millennium BC have been discussed in great detail by many archaeologists (Kenoyer 1995; Kohl 1978, 1979, 1987; Lamberg-Karlovsky and Tosi 1973; Law 2008; Mery and Blackman 2005; Olijdam and Spoor 2008; Tosi 1979, etc.).

Chapter 3

Seals in the Pre-/Early Harappan Period in light of the Seals in the Ghaggar Basin

Chapter 3 - Seals in the Pre-/Early Harappan Period in light of the Seals in the Ghaggar Basin

Chapter introduction

Harappan seals are understood as a special item, within a functioning system that controlled the flow of merchants, goods, and much information within urban centres in the urbanized society of Harappan Civilization (c. 2600-1900 BCE). The study of Harappan seals has occupied an important position in the archaeological study of Harappan Civilization that has been discussed from various points of view since the discovery of this Civilization in the 1920's (discussed in Chapter 2).

In the meanwhile, the kind of seals used in the Pre-/Early Harappan period (c. 3000-2600 BCE), before the invention of Harappan seals proper, is not very clear. This chapter will discuss the seals of the Pre-/Early Harappan period in light of the Seals in the Ghaggar Basin in order to understand the seals of Pre-/Early Harappan period and their significance.

1. Background and aims

The chronology discussed in this chapter is restricted in the Pre-/Early Harappan period. Although it is necessary to subdivide this period (c. four hundred years) into some phases for the more detailed archaeological discussions, chronology has not been established so far. But as is indicated by the aspect of pottery, we understand that this period (c. 2700-2600 BCE) was a transitional phase from the Pre-/Early Harappan period to the Mature Harappan period, and can adapt the terminology 'transitional phase' for suitably referring to this period (Possehl 1990; Uesugi 2008; Uesugi and Konasukawa 2008, etc.). The present work restricts its study area to the region of

present North-western India and Pakistan, excluding other regions (i.e. Afghanistan and Iran, etc.), because the main subject of this chapter is to understand various aspects of the seals in those regions which comprised the core of the Harappan Civilization.

Needless to say, there are no Harappan seals in the Pre-/Early Harappan period. As mentioned in Chapter 1, the majority of Harappan seals are square in shape, made of fired steatite (rarely copper or silver) and having a boss on the reverse side. Various motifs of animals (including imaginary animals such as ‘unicorns’ and horned elephants or tigers, etc.) are engraved on the lower portion of the obverse side, along with an average of five Indus characters inscribed on upper portion (Figures 1.1 to 6). Some of the motifs consist of geometric designs such as concentric circles, cross and swastika etc. (Figures 1.3-7). It can be presumed that they had been used as stamp-like object because there are many sealings with one or more impressions derived from the Harappan seal itself (Figures 1.7 to 1.10). In comparison with the seals of the Pre-/Early Harappan period, various main motifs such as unicorn etc. -excluding geometrical ones and Indus letters - are an accurate criterion to distinguish Harappan seals from the seals of the Pre-/Early Harappan period. For this reason, it is most likely that Harappan seals were invented with an entirely new design in the formative period of Harappan Civilization (c. 2700-2600 BCE). In addition, there are different types of seal from Harappan sites in the Pre-/Early Harappan period.

As confirmed in Chapter 2, although there are many previous studies about Harappan seals, the study of seals of Pre-/Early Harappan period is scant up to now. However, as described in the results of recent excavations, it has gradually become clear that the seals having a different design from typical Harappan seals had been used at the present North-western India and Pakistan in the Pre-/early Harappan period (Achaya 2008; Durrani 1994-95; Joshi & Parpola 1987; Kenoyer 2009; Kenoyer & Meadow; Parpola et al. 2010; Shah & Parpola 1991; Sant et al. 2005, etc.). However, there are no detailed studies of these seals since only the basic data of excavated seals was reported

without any detailed analysis in each excavation report. The majority of reports just pointed out the differences between those seals and Harappan seals on the basis of comparative study of motifs engraved on the surface.

In this situation, A. Uesugi pointed out that the seal having the motif based on group of concentric circles is a very distinctive feature and characterizes the seals from this period. He presumed that there was a specific inter-regional relation among the regional cultures of that time based on the discussion on different distribution pattern of some pottery types and seals (Uesugi 2008, 2010, etc.). However, his conjectures are not based on the comprehensive study. Furthermore, some scholars pointed out that it is important to discuss the seals discovered from the sites of Afghanistan and Iran, etc. in the course of studies on the seals in Pre-/Harappan period (Goto 1999; Uesugi 2010, etc.). It can be mentioned, however, that studies concerning relationships between the seals of the Pre-/Early Harappan period and those discovered from outlying areas such as Afghanistan and Iran should be done after basic studies and analyses of the Pre-/Early Harappan seals have been completed, as in the present study. For this reason, as mentioned earlier, the possibility of relationships between the seals of the Pre-/Early Harappan period and those discovered from the sites of Afghanistan and Iran, etc. will not be discussed in this study ⁽¹⁾.

In this chapter, the kind of the seals used in the region of present North-western India and Pakistan, which comprised the core ‘heartland’ of the Harappan Civilization, in the Pre-/Early Harappan period (i.e. before the emergence of Harappan seals) and their significance in the detailed study of the seals in the Ghaggar Basin, especially the site of Kunal, will be appraised. It is also important to analyse the relationship between the seals of Pre-/Early Harappan period and Harappan seals.

2. Seals and sealings in the Pre-/Early Harappan period

The present discussion must be preceded by a description of the classification of

seals in the Pre-/Early Harappan period, in order to avoid complicated descriptions in the course of the discussion and analysis.

There are two types of seal in this period, namely stamp type seal having a boss on reverse side (Figures 3.1-2 to 7, 3.2, 3.3, 3.4-1 to 4, 3.5, 3.6, 6.12 and 16) and button type seal having one or a few perforations on the surface instead of boss (Figures 3.1-1, 6.4 and 5). In this study, the former type is called as 'stamp type seal' and the latter type is called as 'button type seal'. Where button type seals are concerned, it is difficult to accurately pinpoint the function of these objects, even whether they are truly seals or not, due to the shapes. However, the present study assumes the normal convention that button type seals are indeed seals, since there is no evidence for the contrary either.

As far as the shape of the seals is concerned, there are various shapes which comprise the following- 'square shape', 'round shape', 'indefinite shape' and 'animal-like shape'. Various shapes except for 'square shape', 'round shape' and 'animal-like shape' are surmised as 'indefinite shape'. Furthermore 'round shape' includes the oval-shape.

In the course of this study, individual objects will be referred to both by shape and type, such as 'square stamp type seal', 'indefinite-shaped stamp type seal', 'animal-shaped stamp type seal', 'square button type seal' and 'round button type seal', etc. in the course of the analysis of the Pre-/Early Harappan seals in this chapter.

The motifs engraved on the surface of the seals are suitably described because the majority of the motifs consist of geometrical motifs or groups of concentric circles. Though there are various geometrical motifs constituting straight lines, they are summarized as a group of geometrical motifs because of their subdivision is not important from the viewpoint of this study. The raw material and manufacture technique are also suitably described.

2-I. Seals and a sealing excavated from the site of Kunal

The cultural deposit of the Pre-/Early Harappan period was confirmed in

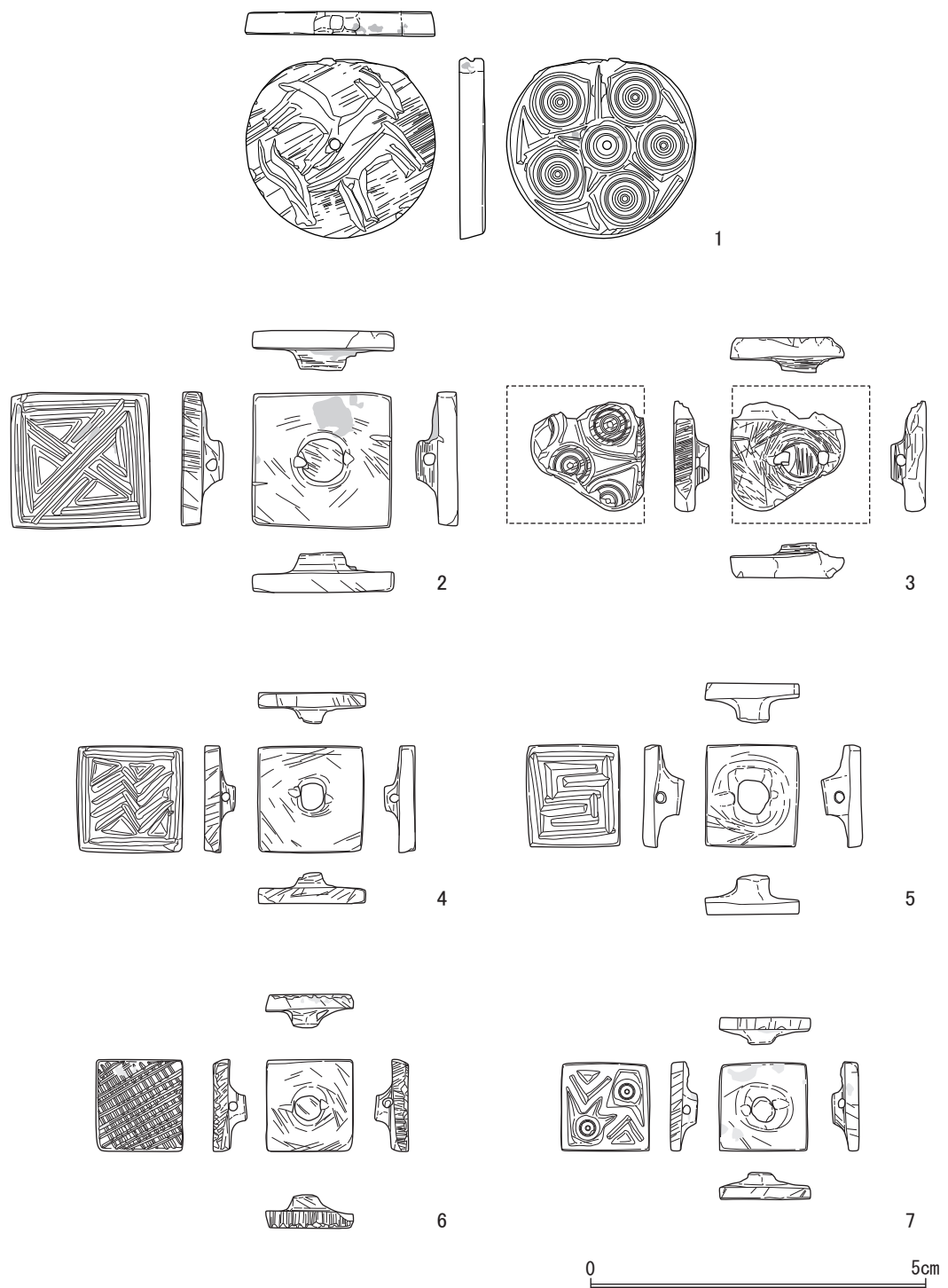


Figure 3.1: Fired steatite seals discovered from the period IC(i) at Kunal (see also Figures 3.2 and 3.3, photographs and PEAKIT images in Figure 6.4, 5, 6, 12 and 16)



Figure 3.1-4 (250%)



Figure 3.1-5 (250%)

Figure 3.2: Fired steatite seals discovered from the period IC(i) at Kunal (see also Figure 3.1)



Figure 3.1-3 (250%)



Figure 3.1-7 (300%)

Figure 3.3: Fired steatite seals discovered from the period IC(i) at Kunal (see also Figure 3.1)

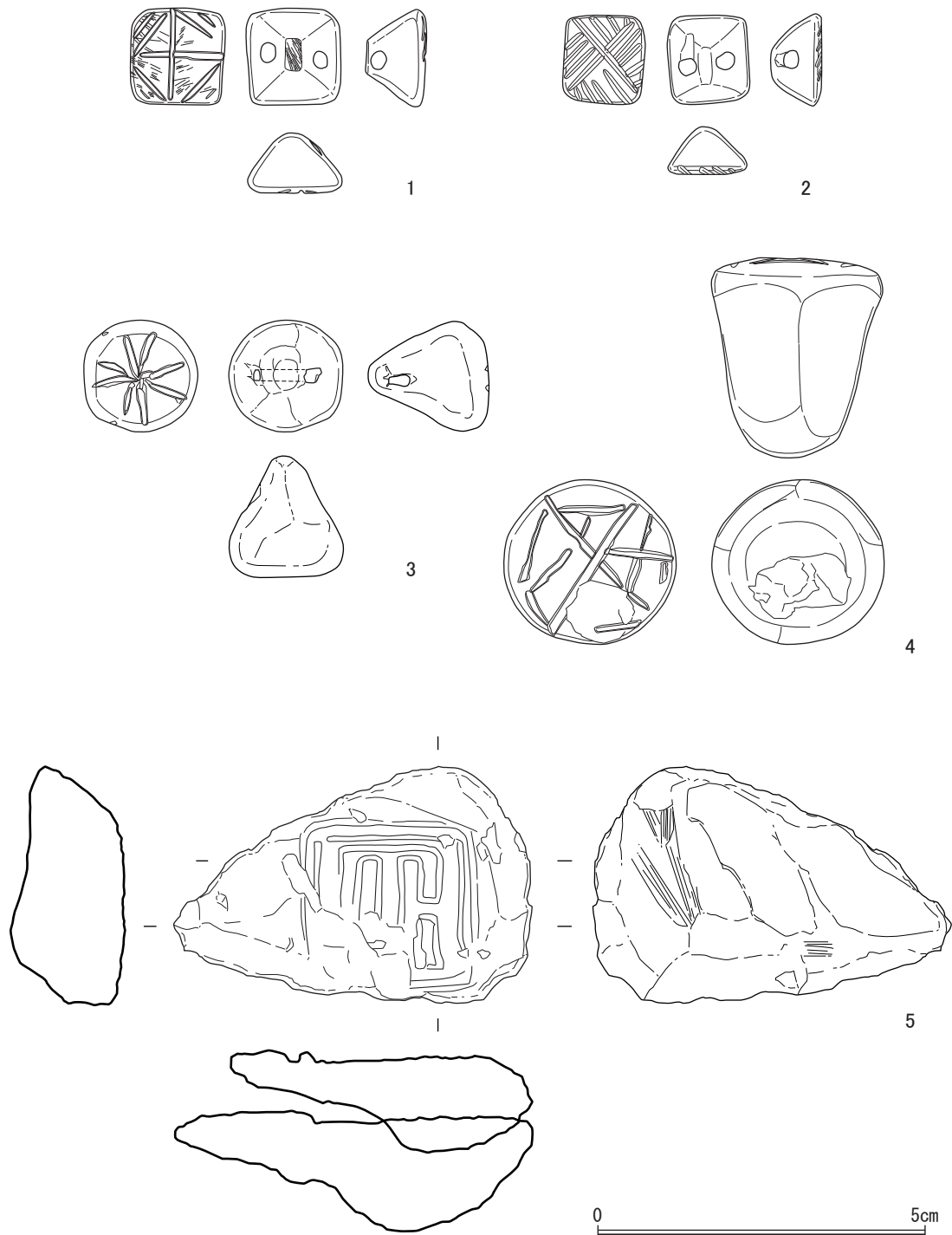


Figure 3.4: Seals and a sealing discovered from the period IC(i) at Kunal (see also Figures 3.5 to and 3.7)



Figure 3.5: Seals discovered from the period IC(i) at Kunal (see also Figure 3.4)

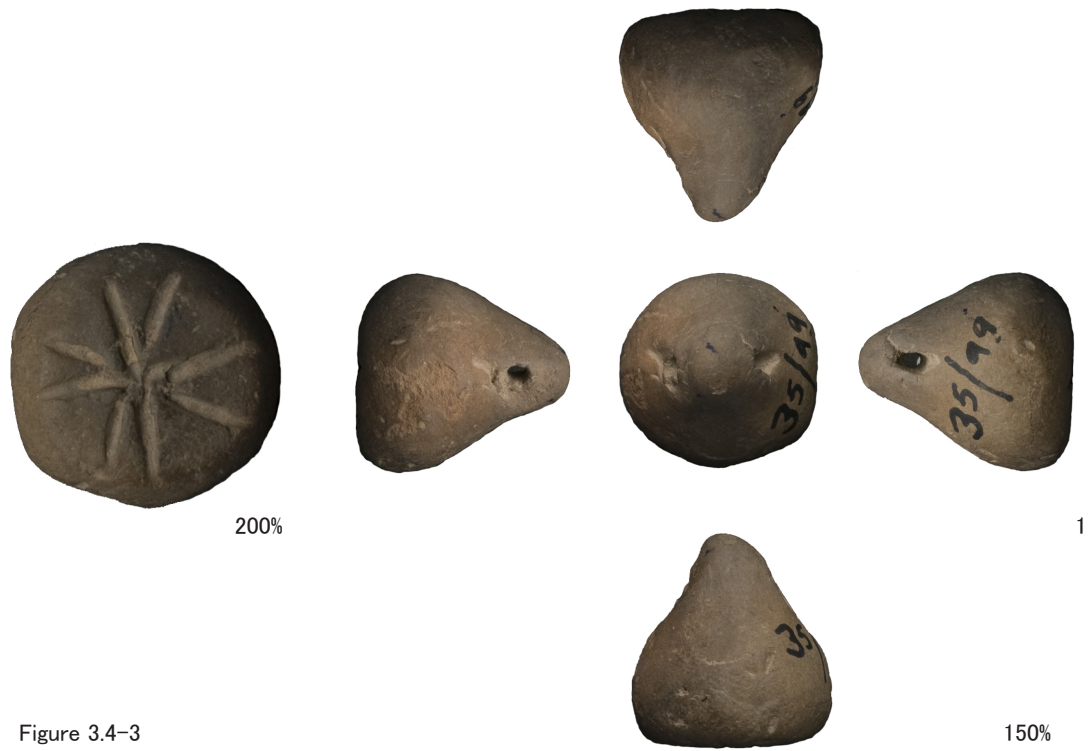


Figure 3.4-3



Figure 3.4-4

Figure 3.6: Seals discovered from the period IC(i) at Kunal (see also Figure 3.4)

Figure 3.4–5 (150%)



Figure 3.7: A Sealing discovered from the period IC(i) at Kunal (see also Figure 3.4)

Table 3.1: Catalogue of basic data of the seals and a sealing discovered from the period IC(i) at Kunal

Figure no	Register no	Period	Motif (s)	Crosswise (mm)	Lengthwise (mm)	Thickness excluding boss (mm)	Thickness including boss (mm)	Weight (g)	Material	Remarks	Source
Figure 2.1-1	KNL-I_438	IC(i)	Two deers (or ibexes) / Group of concentric circles	maximum diameter = 28.5		3.9	-	4.31	Fired steatite		Acharya 2008, 15
Figure 2.1-2	KNL-I_118	IC(i)	Geometric motif	20.5	20.3	3.0	6.1	3.28	Fired steatite		Acharya 2008, 15
Figure 2.1-3	KNL-I_415	IC(i)	Group of concentric circles and cross	21.0	21.0	3.0	5.1	1.02	Fired steatite	Crosswise and lengthwise are restored.	Acharya 2008, 15
Figure 2.1-4	KNL-I_616	IC(i)	Geometric motif	16.0	16.0	2.4	4.9	1.30	Fired steatite		Acharya 2008, 15
Figure 2.1-5	KNL-I_129	IC(i)	Geometric motif	14.0	15.1	2.4	6.0	0.82	Fired steatite		Acharya 2008, 15
Figure 2.1-6	KNL-I_???	IC(i)	Geometric motif	13.0	13.9	2.3	5.0	0.93	Fired steatite		Acharya 2008, 15
Figure 2.1-7	KNL-I_???	IC(i)	Group of concentric circles and geometric motif	13.3	13.0	2.0	4.0	0.85	Fired steatite		Acharya 2008, 15
Figure 2.1-8	KNL-I_153	IC(i)	Geometric motif	14.5	14.8	-	9.1	2.42	Jasper		Acharya 2008, 15
Figure 2.2-1	KNL-I_???	IC(i)	Geometric motif	12.2	13.5	-	8.0	1.67	Shell		Acharya 2008, 15
Figure 2.2-2	KNL-I_135	IC(i)	Geometric motif	maximum diameter = 17.0		-	18.5	4.56	Terracotta		Acharya 2008, 15
Figure 2.2-3	KNL-I_???	IC(i)	Geometric motif	maximum diameter = 26.1		-	30.5	18.48	Terracotta		Acharya 2008, 15
Figure 2.2-4	KNL-I_372	IC(i)	Geometric motif (as an impression)	25.0	24.5	-	-	-	- Terracotta	Crosswise and lengthwise are restored from an impression.	Acharya 2008, 15

* "???" - unknown number.

excavations at the small site of Kunal which spreads over ca. 1.2 ha (Acharya 2008; Khatri and Acharya 1995). Though Period I of the Pre-/Early Harappan phase at Kunal is subdivided into three sub periods, namely periods IA, IB and IC, almost all aspects of Kunal after Period I are not clearly discernible because the upper part of the site is destroyed by modern agricultural activities.

The period IA is characterized by Pottery called Hakra Pottery, and large-sized pits which are assumed to be the dwelling pits (c. 2m in diameter and c. 1m in depth). Although the use of such pits continued into period II, some new aspects such as laying sun-dried bricks to construct the walls are confirmed in this period. Concerning the Pottery of this period, the majority of Pottery comprises the bichrome painted pottery, which are painted with black and white pigments. Some scholars pointed out that the pottery has a lot in common with the pottery excavated from Period I of Kalibangan which belongs to the later part of the Pre-/Early Harappan period. Period IC is further subdivided into IC(i) and IC(ii) phases, and this period is understood as the transitional phase from the Pre-/Early Harappan period to Mature Harappan period. The dwelling architecture changes from the large-sized pits to the rectangular architecture constructed by sun-dried bricks. In addition, fired steatite seals which are discussed in greater detail later and large amounts of ornaments made of gold, silver and bronze (or copper) found as a hoard are reported from this period ⁽²⁾.

Eleven seals and one sealing are excavated from the IC(i) phase of Kunal (Figures 3.1 to 3.7, 6.4, 5, 6, 12 and 16; Table 3.1). The raw materials of seals comprise steatite, jasper ⁽³⁾, shell and terracotta. The seals and one sealing that are discovered from Kunal will be discussed more comprehensively in the following part. The basic data about the size and weight, etc. of the seals and sealing are mentioned in the Table 3.1.

Fired steatite seals comprise of the square stamp type seals and a round button type seal. It is clearly that the former seals share common designs such as a simple cylinder shaped boss on reverse side. The majority of the motifs engraved on the surface are

geometrical motifs comprised of straight lines or concentric circles (Figures 3.1-2 to 7, 3.2, 3.3, 6.5, 12 and 16). On the other hand, it is not clear that the latter seal has a specific function as seal because the seal has motifs on the both sides without any boss. However, as mentioned earlier, the present study follows the convention established by the excavator (Acharya 2008). The engraved motifs of this seal constitute of two deer or ibexes on one side and of concentric circles on the other side respectively (Figures 3.1-1 and 6.7).

A seal made of jasper (Figures 3.4-1 and 3.5-1) and another made of shell (Figures 3.4-2 and 3.5-2) are of the square stamp seal type with triangular shaped cross section. Engraved geometrical motif comprised of straight lines is also common in both seals.

A seal with perforated boss (Figures 3.4-3 and 3.6-1) and another with non-perforated boss (Figures 3.2-4 and 3.6-2), both made of terracotta have been found from the site. They can be classified as the stamp seal based on the shape. With regard to the engraved motifs on the surface, it is difficult to interpret what motifs are exactly depicted.

A terracotta sealing with an impression originating from a square stamp seal was also found (Figures 3.4-5 and 3.7). The motif on the sealing is a geometrical motif composed of straight lines.

2-II. Seals and sealing excavated from other sites

In this part, the seals and sealings discovered from other sites excluding Kunal are analysed in detail (Table 3.2). They will be discussed respectively for each site and the site distribution with the representations of the seals and a sealing from each site will be shown below (Figure 3.8). The following is a list of examples from various sites in the Ghaggar Basin apart from Kunal. Detailed descriptions of the sites have not been given, since the focus of the study is on the seals themselves.

i) Baror (Figure 3.8- ⑧)

Six indefinite-shaped button type seals made of fired steatite (Figure 3.8-1, 2;

Table 3.2: Catalogue of basic data of the seals and the sealings in the Pre-/Early Harappan period

Figure no.	CISI no.	Site	Period	Motif	Type of seal	Direction of head of main animal motif	crosswise lengthwise (mm)→X (mm)→Y	Thickness excluding boss(mm)	Thickness including boss(mm)	Type of boss	Material	Remarks	Source
–	Mr-5	Mehrgarh	IV	Geometrical motif	Button type seal	–	maximum diameter =26.5	–	–	–	Terra-cotta		CISI Vol. 2
–	Mr-6	Mehrgarh	V	10 holes	Button type seal	–	maximum diameter =23.5	–	–	–	?	seal?	CISI Vol. 2
–	Mr-7	Mehrgarh	V	Unidentified motif	?	–	maximum diameter =45.5	–	–	–	?	seal?	CISI Vol. 2
–	Mr-8	Mehrgarh	V	Geometrical motif	Button type seal	–	23.0	12.5	–	–	?		CISI Vol. 2
Figure 2.3-14	Mr-9	Mehrgarh	VI	Geometrical motif	Button type seal	–	*39.0	*29.0	–	–	?		CISI Vol. 2
Figure 2.3-22	Mr-10	Mehrgarh	VII	Geometrical motif	Button type seal	–	maximum diameter =55.0	–	–	–	Terra-cotta		CISI Vol. 2
Figure 2.3-16	Mr-11	Mehrgarh	VII	Geometrical motif	Button type seal	–	*27.0	*18.0	–	–	?		CISI Vol. 2
Figure 2.3-17	Mr-12	Mehrgarh	VII	Geometrical motif	Button type seal	–	*35.0	*23.5	–	–	?		CISI Vol. 2
Figure 2.3-18	Mr-13	Mehrgarh	VII	Geometrical motif	Button type seal	–	*34.0	–	–	–	?		CISI Vol. 2
Figure 2.3-19	Mr-14	Mehrgarh	VII	Geometrical motif	Button type seal	–	*29.0	*29.0	–	–	?		CISI Vol. 2
Figure 2.3-20	Mr-15	Mehrgarh	VII	Geometrical motif or figures?	Button type seal	–	61.0	62.5	–	–	?		CISI Vol. 2
Figure 2.3-23	Mr-16	Mehrgarh	VII	Geometrical motif	Stump type seal	–	maximum diameter =53.5	–	–	–	square (oblong)		CISI Vol. 2
Figure 2.3-21	Mr-17	Mehrgarh	VII	Deer	Stump type seal	Right	maximum diameter =42.5	7.5	22.0	–	?		CISI Vol. 2
Figure 2.3-13	Ns-1	Nausharo	IB	Zebu-shaped	Button type seal	Left	*43.5	*39.0	6.0	12.0	Copper (Bronze)		CISI Vol. 2
Figure 2.3-11	Trq-1	Tarakai Qila	Pre-/Early Harappan	2 deers (on the both sides)	Button type seal	–	maximum diameter =32.5	–	–	–	Fired Steatite	maximum diameter is restored.	CISI Vol. 2
Figure 2.3-9	Trq-2	Tarakai Qila	Pre-/Early Harappan	Groupe of concentric circles	Stump type seal	–	17.5	17.5	2.5	–	Fired Steatite		CISI Vol. 2
Figure 2.3-10	Trq-3	Tarakai Qila	Pre-/Early Harappan	Groupe of concentric circles	Stump type seal	–	*26.5	*27.0	–	–	Fired Steatite		CISI Vol. 2
Figure 2.3-12	Trq-4	Tarakai Qila	Pre-/Early Harappan	Geometrical motif	Stump type seal	–	*25.5	*23.5	–	–	Fired Steatite		CISI Vol. 2
–	Lwn-1	Lewan	Pre-/Early Harappan	Geometrical motif/Sealing	–	–	–	–	–	–	Terra-cotta	sealing with some impressions	CISI Vol. 2
–	Rhd-1	Rahman Dheri	IA	2 scorpions, 1 frog, 1 inscription / 2 deers	Button type seal	–	31.0	27.5	–	–	Ivory		CISI Vol. 2
–	H-1521	Harappa	1	Svasitika?	–	–	–	–	–	–	Bone	seal?	CISI Vol. 3.1
–	H-1533	Harappa	2	Elephant	Stump type seal	Left	19.0	19.0	–	–	Fired Steatite	lengthwise are restored.	CISI Vol. 3.1
–	H-1534	Harappa	2	Geometrical motif	Stump type seal	–	29.5	30.0	–	–	Fired Steatite		CISI Vol. 3.1
Figure 2.3-4	H-1535	Harappa	2	Groupe of concentric circles	Stump type seal	–	17.5	17.5	2.5	5.0	Fired Steatite		CISI Vol. 3.1
–	H-1536	Harappa	2	Geometrical motif	Stump type seal	–	12.5	13.0	–	–	Fired Steatite		CISI Vol. 3.1
–	H-1537	Harappa	2	Geometrical motif / Groupe of concentric circles	Stump type seal	–	22.0	22.0	–	–	Fired Steatite	lengthwise are restored.	CISI Vol. 3.1
–	H-1538	Harappa	2	Unidentified motif/Sealing	–	–	22.5	22.5	–	–	Terra-cotta	sealing	CISI Vol. 3.1
Figure 2.3-3	Tkwd-1	Tarkhanewala Dera	Pre-/Early Harappan	Two deers (or ibexes) / Groupe of concentric circles	Button type seal	–	maximum diameter =28.0	–	–	–	Fired Steatite	maximum diameter is restored.	CISI Vol. 1
Figure 2.3-1	–	Baror	II	Group of concentric circles	Button type seal	–	maximum diameter =18.8	–	–	–	Fired Steatite		Sant et al. 2005, Pl. 20
Figure 2.3-2	–	Baror	II	Group of concentric circles	Button type seal	–	maximum diameter =27.5	–	–	–	Fired Steatite		Sant et al. 2005, Pl. 20
–	–	Baror	II	Group of concentric circles	Button type seal	–	–	–	–	–	Fired Steatite	broken piece	Sant et al. 2005, Pl. 20
–	–	Baror	II	Group of concentric circles	Button type seal	–	–	–	–	–	Fired Steatite	broken piece	Sant et al. 2005, Pl. 20
–	–	Baror	II	Group of concentric circles	Button type seal	–	–	–	–	–	Fired Steatite	broken piece	Sant et al. 2005, Pl. 20
–	–	Baror	II	Group of concentric circles	Button type seal	–	–	–	–	–	Fired Steatite	broken piece	Sant et al. 2005, Pl. 20
–	–	Baror	II	Group of concentric circles	Button type seal	–	–	–	–	–	Fired Steatite	broken piece	Sant et al. 2005, Pl. 20

note1: '*' marks in columns of crosswise and lengthwise mean 'restored diameter' because the shape of seals is indefinite.

note2: CISI = Corpus of Indus Seals and Inscriptions.

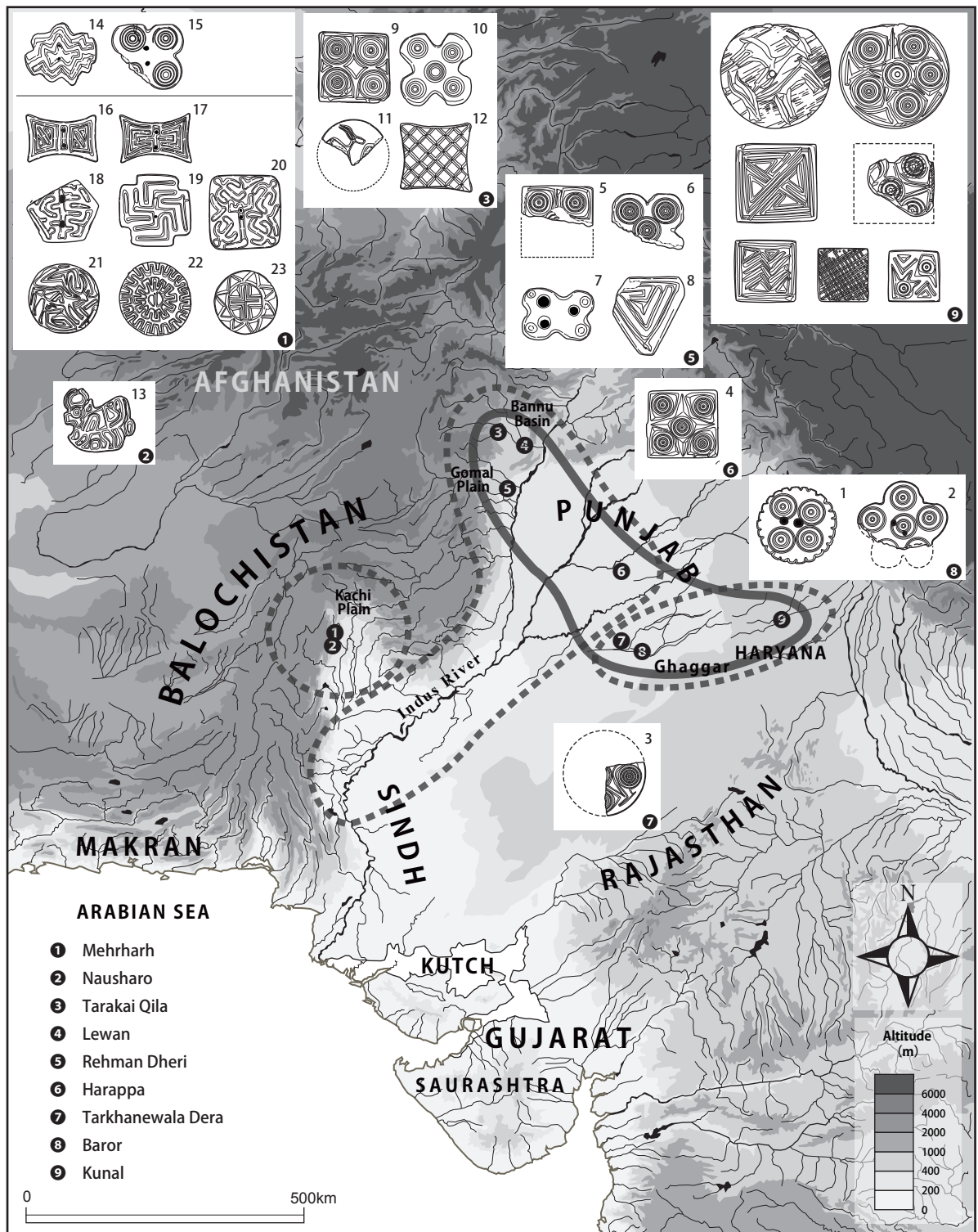


Figure 3.8: Distribution pattern of the seals and the representative pottery types in the Pre-/Early Harappan period (Drawings of the seals in Figure 3.8 are not to scale and each number means each site)

Sant et al. 2005, Pl. 20) are discovered from the period II which belongs to the Pre-/Early Harappan period of Baror. Only concentric circle motifs have been found on the seals from this site.

ii) Tarkhanewala Dera (Figure 3.8- ⑦)

A broken piece of round button type seal made of fired steatite (Figure 3-8; Joshi and Parpola 1987, 363, Tkwd-1), which has something in common with a round button type seal discovered from Kunal (Figure 3.1-1), is excavated from this site. Although the detailed motif is unknown because of the breakage, a deer or ibex and a motif based on concentric circles are engraved on either surface of the seal, respectively. Their motifs are also very similar to the example found at Kunal.

iii) Harappa (Figure 3.8- ⑥)

Five square stump seals made of fired steatite (Figure 3.8-4; Parpola et al. 2010, 211, H-1533-1537) and one terracotta sealing (Parpola et al. 2010, 212, H-1538) are discovered from the period 2 of Harappa, which belong to the transitional phase between the Pre-/Early Harappan period to Mature Harappan period ⁽⁴⁾. The seals have a lot of similarities with the seals from Kunal with regard to the shape, motif and raw material. Although there is a seal having an elephant motif on the surface (Parpola et al. 2010, 211, H-1533), other examples have a geometrical motif consisting of straight lines, concentric circles and their combination. The terracotta sealing has an impression which could have originated from a square stump seal, but the details of its motif are not discernible.

iv) Rehman Dheri (Figure 3.8- ⑤)

A round button type seal made of ivory (Figure 3.9; Shah and Parpola 1991, 352, Rhd-1) is discovered from the period IA (c. 3300-3000 BCE). Two scorpions, a frog and a T-shaped motif are engraved on the one side, two deer or ibexes and a T-shaped motif are engraved on the other side. In continuous periods II and III, many seals, which are made of fired steatite or shell, are reported ⁽⁵⁾. Although a bird-shaped button



Figure 3.9: An ivory seal discovered from the period IA at Rehman Dheri (After Shah and Parpola 1991; not to scale)

type seal is reported (Durrani 1994-95, 205, 2), the majority of the seals comprise of stamp type seals, indefinite-shaped stamp type seal and indefinite-shaped button type seal that are characterized by a geometrical motif constituting straight lines and concentric circles (Figure 3.8-5 to 8; Durrani 1994-95, 202-205, 207).

v) Tarakai Qila (Figure 3.8- ③)

Four seals made of fired steatite are reported from this site belonging to the Pre-/ Early Harappan period. There is one square stamp type seal (Figure 3.8-9, 10 and 12; Shah and Parpola 1991, 414, Trq2-4), two indefinite-shaped stamp type seals (Figure 3.9-9, 10 and 12; Shah and Parpola 1991, 414, Trq2-4) ⁶ and a round button type seal (Figure 3.8-11; Shah and Parpola 1991, 414, Trq1). Concerning the square stamp type seal and the indefinite-shaped stamp type seals, the motifs consist of a geometrical motif, which comprise straight lines and concentric circles. On the other hand, it can be presumed that the motifs of the round button type seal constitute of two deer or ibexes. Although this round button type seal is similar to the examples discovered from Kunal (Figure 3.1-1) and Tarkhanewala Dera (Figure 3.8-3; Joshi and Parpola 1987, 363, Tkwd-1), a seal from this site (Figure 3.8-11; Shah and Parpola 1991, 414, Trq1) has the same motif on the both sides, without a motif based on concentric circles seen on any side.

vi) Lewan (Figure 3.8- ④)

There is no report of any seal found at this site, but one terracotta sealing is reported, which has a few impressions originating from a same square stump type seal (Shah and Parpola 1991, 400, Lwn-1). It is presumed that the motif of this seal is a geometrical motif consisting of straight lines.

vii) Nausharo (Figure 3.8- ②)

An animal-shaped stump type seal made of bronze is reported from the period IB which belongs to the Pre-/early Harappan period of this site. It can be presumed that this seal was made in the shape of a humped bull (Figure 3.8-13; Shah and Parpola 1991, 407, Ns-1).

viii) Mehrgharh (Figure 3.8- ①)

The first report of a round button type seal (Shah and Parpola 1991, 402, Mr-5) goes back to the period IV (c. 3300-3000 BCE) of this site. In the continuous periods V to VII, some square, round and indefinite-shaped button type seals (Figure 3.8-14 to 20; Shah and Parpola 1991, 402-405, Mr-8-15) are reported, but there is no stump type seal⁽⁷⁾. As for the raw material of the Mehrgharh seals, the majority of them comprise terracotta and there are some seals made of stone, shell and ivory. However, there is no example made of fired steatite, which is a common raw material in the other sites. In the period VII, the round stump type seals (Figure 3.8-21 to 23; Shah and Parpola 1991, 405, Mr-16, 17) are confirmed. The motifs of the seals consist of deer and geometric one.

3. Discussion

3-I. Distribution pattern

The details of the seals in the Pre-/Early Harappan period were confirmed in the previous part of this chapter. As is indicated by the observations, it is clear that the seals that are similar to the Kunal seals had been used in this vast area before the invention of Harappan seals (Figure 3.8).

The seals of the Pre-/Early Harappan period comprise the stump type seal and button type seal, that have square, round, indefinite-shaped and animal-shaped surface respectively. They are not as stylized as the Harappan seals. In terms of raw material, there are seals made of terracotta, jasper and shell, in addition to the more common fired steatite. Although there are some examples which are characterized by animal motifs such as elephant and deer or ibex, the majority of the motifs are geometrical, consisting of straight lines and concentric circles.

The distribution pattern of the seals in the Pre-/Early Harappan period is shown in Figure 3.8. All sites with seals or sealings are plotted in the same (Figure 3.8). On the other hand, there is no report of the seal and sealing in the rest of the area depicted in this map. For instance, there is no report of the seal from the Sindh region ⁽⁸⁾.

A round button type seals having two deer or ibex motif on the surface are reported from Tarakai Qila, Tarkhanewala Dera and Kunal respectively. Two examples from Tarkhanewala Dera and Kunal are different from a Tarakai Qila seal, because they have a motif based on concentric circles on one side. It is very interesting to note that these types of seal, which have a similar design, were distributed in the vast area. All of this type of seals are made of fired steatite.

Two animal-shaped stump type seals are reported from Nausharo and Rehman Dheri respectively. This type seal is not a common type in the Pre-/Early Harappan period because there are no similar examples.

The majority of square or indefinite-shaped stump and button type seals are distributed in the northern area which comprise of Gommal, Punjab and Haryana regions, including the Ghaggar Basin (circled area by broad line in Figure 3.8) ⁽⁹⁾. These seals are mostly decorated with geometrical motifs consisting of straight lines and concentric circles. It is noteworthy that the motif based on group of concentric circles is a very distinctive feature and characterizes the seals from this period (Uesugi 2010). The most common form of raw material is fired steatite.

Three sealings with an impression from a square stump type seal are also discovered in the northern area (i.e. Lewan, Harappa and Kunal).

As is indicated by this analysis, it is most likely that the stump and button type seals, made of fired steatite and typified by similar motifs had been used in the northern area at the same time. Although understanding the meaning of different seal types is a difficult proposition, it is worth mentioning here that the seals characterized by common motifs had been used in specific areas during the Pre-/ Early Harappan period.

Vis-à-vis the relationship of the seals in the Pre-/Early Harappan period and Harappan seals, it should be noted that both the seals that were square in shape, made of fired steatite with a boss on reverse side, and the typical Harappan seals, were distributed in the northern area. It can be presumed, therefore, that the manufacture technique is also common, because the motifs of the seals are expressed by the carving technique (this issue will be further elaborated upon through SEM and 3D analyses in Chapter 6). It can also be noted that these features give us important clues for considering the origin of Harappan seals.

3-II. Size of the seals in the Pre-/Early Harappan period

The graph in Figure 3.10 shows scatter plot of measurements of the seals of the Pre-/Early Harappan period (i.e. square stump seal and round button seal in fired steatite). The size measurements (lengthwise and crosswise or maximum diameter in round button seal) are simply taken by measuring drawings or photographs of each seal published in excavation reports. Measurements were recorded in millimeters, rounded to the nearest tenths.

Although data for this analysis is not sufficient, the seals were classified into two size categories based on scatter plot of these measurements (Figures. 3.10), namely large-size category (32.5 to 28.0 mm) and small-size category (22.0 to 12.5 mm). All of round button seals are classified into the large-size category and both categories are confirmed through all of sites examined.

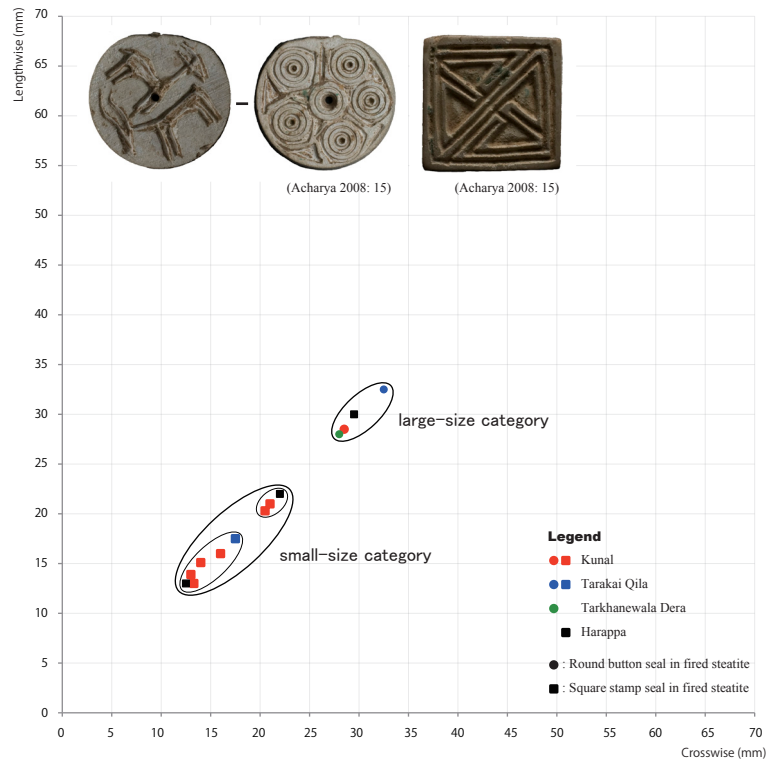


Figure 3.10: Scatter plot of the measurement of seals in the Pre-/Early Harappan period

Although size categories in the seals of the Pre-/Early Harappan period are not as clear when compared with the size category of Harappan seals (discussed in next Chapter), we can confirm two size categories in the seals.

3-III. Historical significance of the distribution pattern of the seals in the Pre-/Early Harappan period

In this part, the historical meaning of the distribution pattern of the seals in the Pre-/Early Harappan period, on the basis of a relationship with the distribution pattern of representative Pottery types, will be discussed.

The Harappan seals were part of a functioning system that controlled the flow of merchants, goods, and much information within urbanized centers along with the weights and measures system within the society of Harappan Civilization (Kenoyer 1991b, 1995, 2000; Koiso and Konasukawa 2009; Konasukawa 2007, 2011a, 2011b,

etc.). In other words, it can be pointed out that the existence of the seals (typified by common design), and sealings having the impression(s) of the seal, reflects the flow of merchants, goods, and much information in the distribution area of the seals or between the sites having them.

In the period IC(i) of Kunal, total of eleven seals and one sealing are excavated along with a hoard consisting of 3,370 carnelian beads, 2,806 fired steatite beads, 5,690 lapis lazuli beads, 487 shell beads and 92 agate beads (Acharya 2008) ⁽¹⁰⁾. Similar archaeological evidence which shows a relation in the seals and manufacture of beads is also reported from Rehman Dheri (Durrani 1988, 1994-95; Durrani et al. 1991, etc). As indicated by this evidence, it can be pointed out that the seals of the Pre-/Early Harappan period had some relation to the flow of goods such as beads, which was given considerable importance in the Indus region. Although a hoard such as at Kunal is exceptional evidence in this period, the evidence above shows a relationship between the flow of goods and the usage of seals.

As this analysis describes, it is assumed that the seals of the Pre-/Early Harappan period were an important part of the functioning system that controlled the flow of merchants, goods, and much information in the area where the seals were used as well as Harappan seals.

Next, the meaning of the relationship of specific distribution patterns of the seals and the representative Pottery types in the Pre-/Early Harappan period can be explored.

The distribution patterns of the representative Pottery types in the Pre-/Early Harappan period could be summarized as follows.

Quetta Pottery, which is characterized by various animal, naturalistic and geometrical motifs, was distributed in Balochistan to the west of the Indus plain, especially the Quetta region in central Balochistan (Fairervis 1956, 1959, 1967, 1975; Franke-Vogt 2008a; Jarrige 1986, 1988, 1989, 1990 1997, Jarrige et al. 1995; Konasukawa 2010; Konasukawa et al. 2011; Quivron 1994; Samzun 1992, etc.).

Kot Diji Pottery, which is characterized by the black colored banded paintings on the short neck, was distributed in the Bannu, Punjab and Sindh regions (Allchin et al. 1986; Dani 1970-71; Durrani 1988; Durrani et al. 1991; Halim 1972a, 1972b; Jenkins 1994; Khan 1965; Konasukawa 2006, 2008c; Mughal 1970, etc.).

Soti-Siswal Pottery, which is characterized by different shapes and paintings in comparison with Kot Diji Pottery, was distributed in the northern Rajasthan and Haryana regions (Acharya 2008; Dalal 1980, 1981, 1987; Dikshit 1984; Frenchman 1972; Lal et al. 2003; Nath 1998,1999; Nigam 1996; Suraj Bhan 1971-72, 1975; Thapar 1969; Uesugi 2011b, etc.).

As Figure 3.8 describes, although each Pottery type maintains loose relationships between them respectively, they were basically distributed independently in each specific region (Uesugi 2008; Uesugi and Konasukawa 2008; Konasukawa 2008a, 2008b, etc.).

On the other hand, it is clear that the distribution of seals from the Pre-/Early Harappan period operated over a wider area than regions united by a specific pottery type (circled area by broad line in Figure 3.3).

This study concludes that it is likely that before the Harappan seal was invented in the northern area, where seals typified by same motifs were used, there was a functioning system that controlled the flow of merchants, goods, and much information, a cultural exchange that operated over a wider area than regions united by a specific pottery type.

4. Chapter conclusion

In summary, this chapter examined the seals of the Pre-/Early Harappan period in light of the seals in the Ghaggar Basin, especially the seals from Kunal, and their significance.

Through the analysis of this chapter, it has become evident that Pre-/Early

Harappan seals consist of stamp type seals and button type seals typified by common motifs such as geometric designs or concentric circles, and that among these, steatite seals are concentrated specifically in the northern area which comprise of the Gomati, Punjab, and Haryana regions including the Ghaggar Basin. Three sealings having the impression(s) of a square-stump type seal are also reported from this area. Furthermore, in order to consider the significance of these seals, their distribution patterns are compared with that of specific pottery types and that of Harappan seals.

As mentioned above, the present study concludes that it is likely that before the invention of Harappan seal in the northern area (including the Ghaggar Basin) seals typified by similar motifs were used, within functioning trade network that controlled the flow of merchants, goods, and information in the area, resulting in a cultural exchange that operated over a much wider area than regions united by a specific pottery type.

Although the data for this analysis is scarce, and there are some examples which should be carefully taken into consideration on account of their chronological position, it may be mentioned that this conclusion shows an aspect of accuracy as far as the seals of the Pre-/Early Harappan period and their significance are concerned ⁽¹¹⁾.

Notes

- 1) It is important on this point to discuss the seals discovered from Mundigak (Casal 1961) and Shahr-i Sokhta (Feroli et al. 1979; Fiandra and Feroli 1984; Lamberg-Karlovsky and Tosi 1973), etc.
- 2) Though the final report of the excavations at Kunal have not been published yet, a preliminary report (Acharya 2008) is already published. In the report, C14 dating has assigned a date of 2577 BC to the period IC, but there is no mention of whether the C14 date belongs to Phase IC(i) or IC(ii). However, from the style of the Pottery excavated at Kunal, it is possible to place IC(i) phase to the Pre-/Early Harappan period or transitional phase from the Pre-/Early Harappan period to Mature Harappan period. As far as the context of the fired steatite seals excavated from Kunal is concerned, there is only one description in the report that the seals were excavated from the IC(i) phase.
- 3) Although this seal is reported as being made of shell in the report (Acharya 2008, 14), it is more likely that the raw material is actually jasper by the observations made in the course of the present study.
- 4) One seal made of bone (Parpola et al. 2010, 207, H-1521) is reported from the period 1 (c. 3300-2800 BCE). But the seal is excluded in this study because of breakage, and lack of detailed information. Although a broken example (Parpola et al. 2010, 211, H-1537) is also excavated from the period 3C, the excavators understand that this seal can actually be placed in the period 2 based on the typology of its motif (Kenoyer and Meadow 2010).
- 5) The accurate number of the seals cannot be counted based on the photographs in the excavation reports (Durrani 1994-95), because the seals displayed in the reports comprise many broken pieces or individual pieces from the same seal, making it difficult to identify individual seals. Furthermore, concerning the raw material of the seals, it is also difficult to classify them based on the descriptions in the reports, because it is possible that the excavators confused the seals made of fired steatite with the seals made of shell etc.
- 6) I interpreted the examples (Figure 3.8-9, 10 and 12; Shah and Parpola 1991, 414, Trq3, 4) as the stump type seal based on the photographs, because the seals have no perforations on the surface.
- 7) An example (Shah and Parpola 1991, 402, Mr-6, 7) is not included in the analytical data of this study because this seal could not be classified as button type seal from the shape of seal. According to the motifs and shapes of the seals discovered from Mehrgarh, it can be said that they are similar to the seals discovered from Mundigak in Afghanistan (Casal 1961) and Shahr-i Sokhta in Iran (Lamberg-Karlovsky and Tosi 1973) rather than the seals discovered from the sites in the Indus region (Goto 1999; Uesugi 2008, etc.). Furthermore based on the manufacture technique, there are some examples which have motifs created by the drilling technique, not by engraving (or carving). The drilling technique is basically recognized in the seals excavated from Mundigak and Shahr-i Sokhta. This technique has not been confirmed in the sites mentioned above (i.e. Figure 3.3- ③ to ⑨) so far. It is necessary to discuss this issue in future studies.
- 8) One indefinite-shaped button type seal typified by a group of concentric circles is reported from the site of Sarai Khola (Halim 1972a, 1972b) and two button type seals (one is round-shaped and the other is indefinite-shaped) typified by geometrical motifs are reported from Damb Sadaat (Fairservis 1956, 1959, 1967, 1975). These seals should also be taken into consideration, but unfortunately, precise data is not yet sufficiently available.
- 9) The site of Mehrgarh is not included in the northern area in this study, because the Mehrgarh seals have some different features, such as the aspects mentioned in note 7 and in the selection of raw material (i.e. terracotta, not fired steatite), in comparison with the seals from the northern area.
- 10) In the course of this study, it was possible to check all of beads as a hoard at the Department of Archaeology

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and Museums, Haryana. As is indicated by the report (Acharya 2008), it can be interpreted that all of beads had been stored in a ceramic pot or jar.

11) Some views and subjects for further analysis are outlined and described here. The stamp type and button type seals as typified by common motifs such as geometric designs or concentric circles continued into the Mature Harappan period, too (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991, etc.). In the site of Baror, six indefinite-shaped button-type seals made of fired steatite (Figure 3.8-1, 2; Sant et al. 2005, Pl. 20) are discovered from period II which belongs to the Pre-/Early Harappan period and some square/indefinite-shaped stamp type seals typified by common motifs such as geometric designs or concentric circles, are reported along with the Harappan seals in the period III, which belongs to the Mature Harappan period (Sant et al. 2005, Pl. 21,22). On the other hand, the majority of the seals reported from period 2 of Harappa and period IC(i) of Kunal (that belong to the transition period from the Pre-/Early Harappan period to Mature Harappan period c. 2700-2600 BCE), comprises of the square stamp type seal having a boss on the reverse side. Furthermore, it is interesting that the raw material of the seals basically comprises of fired steatite because the emergence of the square stamp type seals having a boss on reverse side, made of fired steatite, yield some important clues for discussing the origin of Harappan seals. A further investigation of typological change of the seals in the period ranging from the Pre-/Early Harappan period to Mature Harappan period must be carried out after the accumulation of reliable data with proper context. When discussing the origins of the Harappan seal, A comparison of the production technique of the square stamp type seals of the Pre-/Early Harappan period with that of Harappan seals may yield important clues for the analysis (This issue will be discussed in a full sense through SEM and 3D analyses in Chapter 6).

Chapter 4

Harappan seals and their Significance

Chapter 4 - Harappan seals and their Significance

Chapter introduction

Chapter 4 examines the details of Harappan seals as the primary research material of this study and their significance through the analyses of the various sizes of Harappan seals and of motifs depicted on the surface of the same.

1. Background and aims

Many studies have been carried out on Harappan seals, not only to decipher the Indus script but also to search for clues to understand the social organization of the Indus people based on the size and motifs of the seals (discussed in Chapter 2).

Size is obviously an important factor, and Parpola has pointed out that certain specific inscriptions are inscribed on bigger seals (Parpola 1986). Size and motifs are likely to reflect socio-economical and political aspects as well as religious or belief systems of the Harappan society. Rigid standardization of size and arrangement patterns of motifs most probably reflect commercial or religious hierarchies of the owners (Koiso and Konasukawa 2009; Konasukawa 2007, 2011a, 2011b).

This study also follows the same approach, and focuses on both size and motifs to understand the details of Harappan seals. Data for analysis is based on *the CISI* edited by J.P. Joshi and A. Parpola (Vol.1, 1987), by S.G.M. Shah and Parpola (Vol.2, 1991) and by Parpola, B.M. Pande and P. Koskikallio (Vol.3, 2010).

2. Method and basic data for analysis

Although 86.5% or 1542 out of 1783 seals are concentrated in Mohenjodaro and Harappa as the two major urban centers in this Civilization, a few examples are

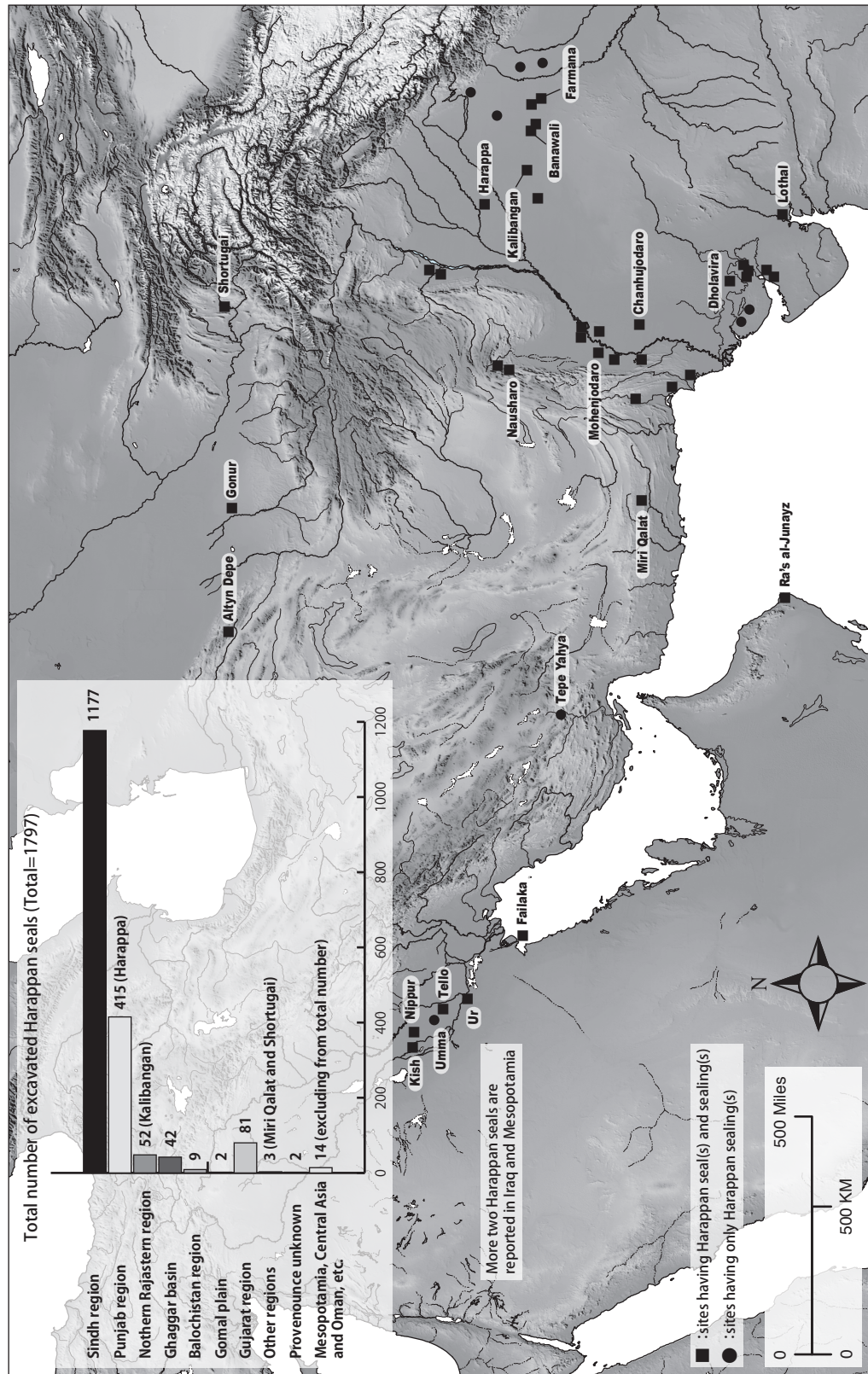


Figure 4.1: Sites that have yielded Harappan seal(s) and the sealing(s)



Figure 4.2: Sites and regions discussed in the present study

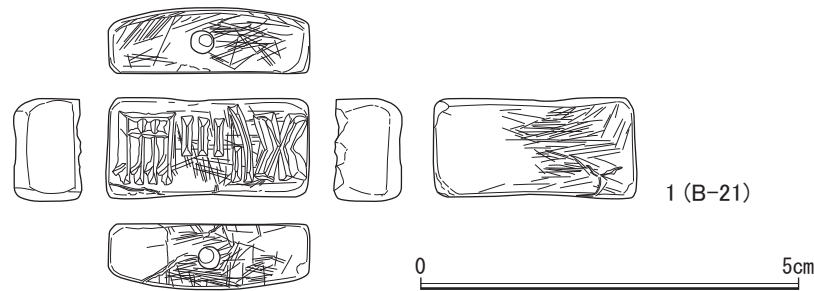


Figure 4.3: A convex-type seal discovered from the period II at Banawali (see also photographs and PEAKIT images in Figure 6.75)

nonetheless discovered at even middle or small size urban centers that are distributed in each region. Seals are found not only within the geographical extent of the Harappan Civilization itself (covering entire Indus Plain and its surrounding regions), but also from a number of sites in Mesopotamia, the Persian Gulf regions, the Iranian Plateau as well as Turkmenistan (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991, etc) (Figures 4.1 and 4.2).

The Harappan seals can be divided into three types based on their shape and style of depicting motifs and scripts:

- (I) square seals having a boss on reverse (Figures 1.1 to 1.3),
- (II) square seals having motifs and scripts inscribed on both obverse and reverse and thus having no boss (M-326, M-1224 and M-1225, etc. in *the CISI*),
- (III) oblong seals having convex shaped cross section with a hole pierced across its section, instead of carving out separate boss. Only scripts are inscribed on obverse without any other motifs (Figure 4.3).

This study focuses only on type (I) seals, since this type makes up the largest number of seals excavated from many sites in various regions ⁽¹⁾. Tablets in bas-relief (Figure 4.4) are also not discussed in this study.

Chronological and typological variations in Harappan seals should also be taken into consideration, but unfortunately, there is not enough data on the same to warrant a



Figure 4.4: A tablets in bas-relief discovered from the period II at Banawali

serious study⁽²⁾.

For the analysis, these square type seals are first classified based on the motifs and then by size measurements (lengthwise and crosswise). The size measurements are simply taken by measuring photographs of each seal published in three volumes of *the CISI* (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991) and so on. In this study, only the seals found within the territory of the Harappan Civilization are considered for analysis.

The number of seals from these three volumes in which motifs could be identified amounts to 1740 seals, with additional 43 seals from the more recent excavations (so far unpublished in *the CISI*) (Besenval and Marquis 1993; Davalikar, et al. 1996; Francfort 1989; Kharakwal et al 2012; Konasukawa 2011a; Konasukawa et al. 2011; Kumar and

Dangi 2007; Mallah 2008; Mackay 1943; NHK and NHK Promotions 2000; Rao et al. 2004; Sant et al. 2005). This amounts to 1783 seals, out of which 1597 seals could be measured (Tables 4.1 to 4.3) ⁽³⁾.

According to the following rules, a total count was taken of the number of published seals. Concerning the motifs on the seals, only seals with an accurate animal motif were counted in the study and classification is essentially based on *the CISI* (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991).

However, even if the motif is recognized as a unicorn in *the CISI*, some seals where the motif is unclear or indiscernible were excluded from the data for analysis. Regarding the direction of the motifs (i.e. left or right), the data consists only of seals having an animal motif showing the direction of head clearly. If the seal has an animal motif that shows the direction of the head clearly, even if the seal was not counted as data for scaling the size, I counted the seal for analysis about direction of the motif.

Measurements were recorded in millimeters, rounded to the nearest tenths. Based on scatter plot of these measurements (Figures 4.5 to 4.15), the seals were classified into various size categories as mentioned below. The thickness of seals is also an important factor for analysis, but unfortunately no photographs of lateral sides are shown in *the CISI*, and no such data could be collected.

There are about 51 unfinished and 169 broken seals recorded in *the CISI* and other reports, but these are omitted from the present analysis. And in discussions regarding the ‘direction’ of the motif, the seals having non-animal motif(s) are excluded (i.e. geometrical motif etc.).

The method of referring to Tables 4.1 to 4.3 is given as follows. In the tables, a description given as “816 (763) / 821 (7)” in case of the seals having a unicorn motif discovered at Mohenjodaro. This description means that “the number of seal having an accurate motif (the number of seal for scaling of the size) / the number of the seal showing accurate head direction of animal (the number of seal having a right-facing animal). A

Table 4.1: The number of excavated Harappan seals (1)

Main motifs of Harappan seals		Sindh region							
		Mohenjodaro	Chanhudaro	Allahdino	Baskot	Kot diji	Anri	Jhukar	Lakhanjodaro
Single Motifs	Bison	62 (59) / 61	1 (1) / 1						
	Zebu	45 (40) / 45 (1)							
	Elephant	35 (30) / 35						1 (1) / 1	
	Rhinoceros	20 (18) / 19 (3)		1 (1) / 1					
	Goat	6 (6) / 6 (4)	1 (1) / 1 (1)						
	Tiger	12 (11) / 13	1 (1) / 1						
	Buffalo	11 (9) / 10 (3)							
	Other bovines (Jurus)	4 (3) / 4			1 (1) / 1 (1)				
	Chariot	2 (2) / 2							
	Wild ass								
	Rabbit								
	Bird								
	Unicorn	816 (763) / 821 (7)	18 (17) / 18 (1)	5 (5) / 5	4 (4) / 4	1 / 1		1 (1) / 1	2 (1) / 2
	Composite animal	14 (12) / 14							
	Composite human figure ('horned deity')	3 (1)							
	Three headed animal (joined animal)	5 (5) / 5 (2)	1				1 (1) / 1 (1)		
	House	1 (1)							
	Plant in a vase		1 (1)						
	Offering stand								
	Ship								
	Harp		1 (1)						
	Other unidentified motifs		2 / 2	1 / 1 (1)					
Group Motifs	Real motifs	11 (11) / 2 (2)	2 (1) / 2 (1)						
	Imaginary motifs	3 (3) / 1							
Geometric Motifs	Horned deity (deities) with either/and human figure (s), animal (s) and plant (s)	1 (1)							
	Animals	1 (1)							
	Animals with plant	1 (1)							
	Svastika	51 (50)							
	Group of concentric circles	4 (4)							
Only Scripts	Cross	7 (7)							
	Others	4 (4)							
	Unfinished Seals	10 (10)	2 (2)	1 (1)					
	Broken Seals	19	2						
Total		1127 (1052) / 1038 (22)	30 (25) / 25 (3)	8 (7) / 7 (1)	5 (5) / 5 (1)	1 / 1	1 (1) / 1 (1)	2 (2) / 2	1 (1) / 1
		1177 (1094) / 1081 (26)							

Table 4.2: The number of excavated Harappan seals (2)

Main motifs of Harappan seals			Punjab region		Northern Rajasthan and Haryana regions							Kachi Plain and Balochistan region				Gomal Plain	
			Harappa	Kalibangan	Banawali	Farnana	Bhrrana	Baror	Rakhigarhi	Nausharo	Pirak	Nindowari	Gumla	Maru II			
Single Motifs	Real Animals	Bison	15 (12) / 15	3 (3) / 3												1	
		Zebu	8 (6) / 8 (1)	1 (1) / 1		1 (1) / 1											
		Elephant	8 (6) / 8	1 (1) / 1 (1)													
		Rhinoceros	1 (1) / 1	1 (1) / 1	2 (2) / 2 (2)												
		Goat		3 (3) / 4 (1)	7 (7) / 7 (6)		1 (1) / 1 (1)										
		Tiger	3 (3) / 3	1 (1) / 1 (1)													
		Buffalo	2 (2) / 2	1 (1) / 1	1 (1) / 1 (1)	1 (1) / 1 (1)	1 (1) / 1 (1)										
		Other bovines (urus)		1 (1) / 1 (1)	2 (2) / 2 (2)												
		Gharial															
		Wild ass															
		Rabbit	1 / 1														
		Bird															
	Unicorn	305 (245) / 305 (3)	26 (24) / 26 (6)	3 (3) / 3 (2)	2 (2) / 2 (1)	2 (2) / 2 (1)	1 (1) / 1	1 (1) / 1	4 (4) / 4	1 (1) / 1	2 (2) / 2						
	Composite animal	4 (1) / 4		1 (1) / 1 (1)													
	Imaginary Animals and Deity	Composite fuman figure ('horned deity')		2 (1) / 1 (1)						1 (1) / 1 (1)							
Three headed animal (joined animal)			2 (2) / 2 (1)			1 (1) / 1 (1)											
Other Motifs	House																
	Plant in a vessele																
	Offering stand	1 (1)															
	Ship	1 (1)															
	Harp																
	Other unidentified motifs	2	4 / 3	3 / 3 (3)		3	1										
	Human figure (s) and animal (s)		2 (1) / 1 (1)	1 (1) / 1 (1)													
Group Motifs	Horned deity (deities) with either/and human figure (s), animal (s) and plant (s)	1 (1)				1 (1) / 1											
	Animals																
Geometric Motifs	Animals with plant																
	Swastika	38 (38)								1							
	Group of concentric circles	3 (3)	2 (2)				1 (1)										
	Cross	12 (12)															
	Others	9 (9)		2 (2)		2 (2)		2 (2)				1 (1)					
	Only Scripts	1 (1)	2 (2)	1 (1)													
	Unfinished Seals	10	7														
	Broken Seals	58	1			1	1										
	Total	415 (342) / 347 (4)	52 (44) / 46 (13)	23 (20) / 20 (18)	4 (4) / 4 (2)	9 (6) / 6 (4)	5 (4) / 1	1 (1) / 1	5 (5) / 5 (1)	2 (1) / 1	2 (2) / 2	1 (1)	1		2 (1)		
			42 (35) / 32 (24)													9 (8) / 8 (1)	

Table 4.3: The number of excavated Harappan seals (3)

Main motifs of Harappan seals		Gujarat region					Makran region	Afghanistan	Provenience	Total	Percentage of seals in total number	Percentage of seals in right-facing animal
		Lothal	Dholavira	Surkotada	Kamher	Kuntasi	Pabunath	Min Qalat	Shortugai			
Single Motifs	Bison	3 (3) / 3	1 (1) / 1 (1)							86 (78) / 84 (1)	4.8%	1.2%
	Zebu									55 (48) / 55 (2)	3.1%	3.6%
	Elephant									44 (37) / 45 (1)	2.5%	2.2%
	Rhinoceros								1 (1) / 1	26 (24) / 25 (5)	1.5%	20.0%
	Goat	1 (1) / 1								19 (18) / 20 (13)	1.1%	65.0%
	Tiger	1 (1) / 1	1 (1) / 1							19 (18) / 20 (1)	1.1%	5.0%
	Buffalo									17 (15) / 16 (6)	1.0%	37.5%
	Other bovines (urus)									8 (7) / 8 (4)	0.5%	50.0%
	Gharial									2 (2) / 2	0.1%	–
	Wild ass				1 (1) / 1					1 (1) / 1	0.05%	–
	Rabbit									1 / 1	0.05%	–
	Bird	1 / 1								1 / 1	0.05%	–
	Unicorn	46 (38) / 45	6 (6) / 6	1 (1) / 1			1 / 1	1 (1) / 1		1250 (1123) / 1254 (21)	70.1%	1.7%
	Composite animal									19 (14) / 19 (1)	1.1%	5.3%
	Composite fuman figure (horned deity)									5 (5) / 3 (2)	0.3%	66.7%
	Three headed animal (joined animal)		2 (2) / 2 (2)							12 (11) / 11 (7)	0.7%	63.6%
Group Motifs	House									1 (1)	0.05%	–
	Plant in a vasele									1 (1)	0.05%	–
	Offering stand									1 (1)	0.05%	–
	Ship									1 (1)	0.05%	–
	Harp									1 (1)	0.05%	–
	Other unidentified motifs	1								17 / 9 (4)	1.0%	44.4%
	Human figure (s) and animal (s)		1 (1) / 1 (1)							17 (15) / 7(6)	1.0%	85.7%
	Horned deity (deities) with either/and human figure (s), animal (s) and plant (s)		2 (2)							7 (7) / 2	0.3%	–
	Animals									1 (1)	0.05%	–
	Animals with plant									1 (1)	0.05%	–
Geometric Motifs	Swastika	3 (3)						1		96 (93)	5.4%	–
	Group of concentric circles									10 (10)	0.6%	–
	Cross	1 (1)								20 (20)	1.0%	–
	Others	2 (2)	1 (1)		1 (1)					22 (22)	1.2%	–
	Only Scripts	3 (3)		1 (1)						21 (21)	1.1%	–
Unfinished Seals		11	2							51	–	–
Broken Seals		3			1					169	–	–
Total		62 (52) / 51	14 (14) / 11 (4)	2 (2) / 1	1 (1) / 1	1 (1)	1 / 1	2 (1) / 1	1 (1) / 1	1783 (1597) / 1582 (74)	100%	4.7%
		81 (70) / 65 (4)										

description of just “1” means that “the number of seal having an accurate motif, but there is no data for size scale and for counting about the head direction of animal”, “1 (1)” means that “the number of seals having an accurate motif and size scale, but there is no data for quantifying the head direction of the animal”, “1 / 1” means that “the number of seals having a left-facing accurate animal motif, but there is no data for scaling of the size”, “1 (1) / 1” means that “the number of seals having an left-facing accurate animal and for scaling of the size”, “1 / 1 (1)” means that the number of seal having an right-facing accurate animal motif, but there is no data for scaling of the size” respectively.

Each percentage (%) mentioned in this study is computed from the numerical value described in Tables 4.1 to 4.3.

3. The motifs

The motifs of the Harappan seals can be classified into the following categories and sub-categories. Firstly, they are categorized based on number of objects depicted, either singularly or in groups, and secondly, either real or imaginary beings.

In this study, the manger (feeding trough) sometimes depicted along with bison, elephant, rhinoceros, buffalo and tiger, and so called offering stand (or staff) depicted with unicorn in most cases (also with some goat), are not regarded as a criteria for differentiating motifs ⁽⁴⁾. Although classification of manger and staff is done in *the CISI* (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991), it cannot be dealt with as a research aspect in this study.

3-I. Single motifs

I-A. Real animals:

- i) Bison
- ii) Zebu
- iii) Elephant

- iv) Rhinoceros
- v) Goat (including three variants like ‘markhor’ or ‘antelope’)
- vi) Tiger
- vii) Buffalo
- viii) Other bovine (‘urus’)
- ix) Gharial (gavial) or crocodile
- x) Wild ass
- xi) Rabbit (broken piece only)
- xii) Bird (broken piece only)

I-B. Imaginary animals and ‘deity’:

- i) Unicorn
- ii) Composite animal/human figure
 - a. Combination of various parts of different animals.
 - b. Horned tiger
 - c. Horned elephant (found only as a sealing)
 - d-1. Horned deity-A or priest/shaman wearing horned head gear
 - d-2. Horned deity-B or combination of horned human figure with various parts of different animals
- iii) Three headed animal (Joined animal)

I-C. Other motifs

- i) House
- ii) Plant in a vessel
- iii) Offering stand
- iv) Ship
- v) Harp
- vi) Other unidentified motifs

3-II. Group motifs

II-A. Real animals and figures:

Human figure (s) and animal (s)

II-B. Imaginary:

i) Horned deity (deities) -A or C with either/and human figure (s), animal (s) and plant (s)

ii) Animals in group

iii) Animals with plant

3-III. Geometric motifs

III-A. Swastika

III-B. Group of Concentric circles

III-C. Cross

III-D. Others

3-IV. Only scripts

3-I. Single motifs

I-A. Real animals

i) Bison (Figure 4.5a)

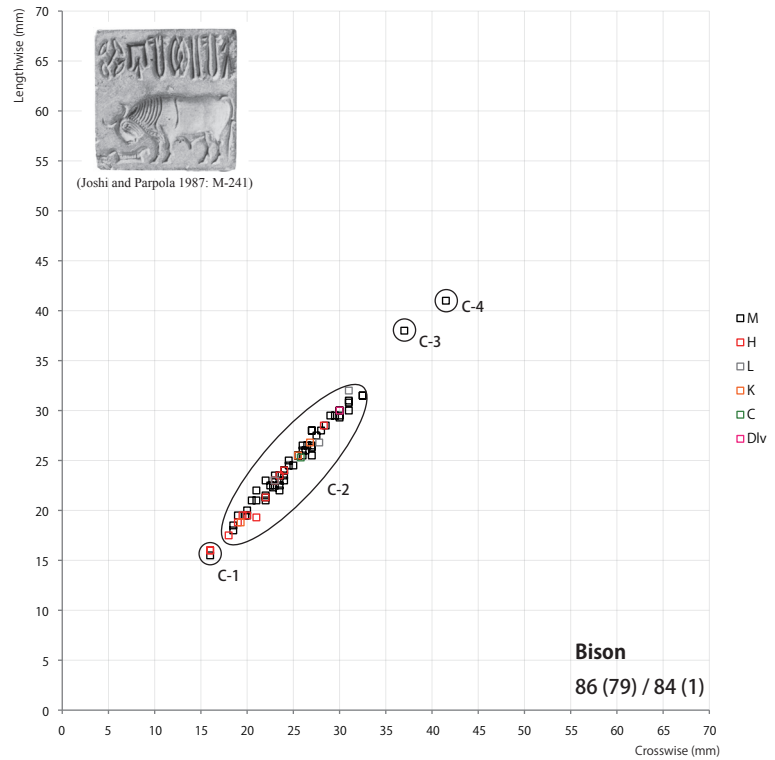
This is short-horned, humpless variety of bovid. Its motif is always depicted with its head bent down towards a manger. The bull motif commonly appears not only on the Harappan seals but also from the so-called Persian Gulf type seals, with a round shape instead of square, found along the Persian Gulf and in Mesopotamia (Al-Sindi 1999, Brunswig, Parpola and Potts 1983; Hallo and Buchanan 1965; Gadd 1932; Kjaerum 1983, 1994; Mitchell 1986, etc.). This may suggest that the bison motif represents a specific group of people who were engaged in long distance trade between Indus, Persian Gulf and Mesopotamia (Koiso 2005; Vidale 2005).

The bison seals constitute 4.9% or 79 out of 1597 seals which their size could be measured (4.8% or 86 out of total of 1783 excavated seals including broken seals).

Chapter 4

Legend (for Fig. 4.5a)

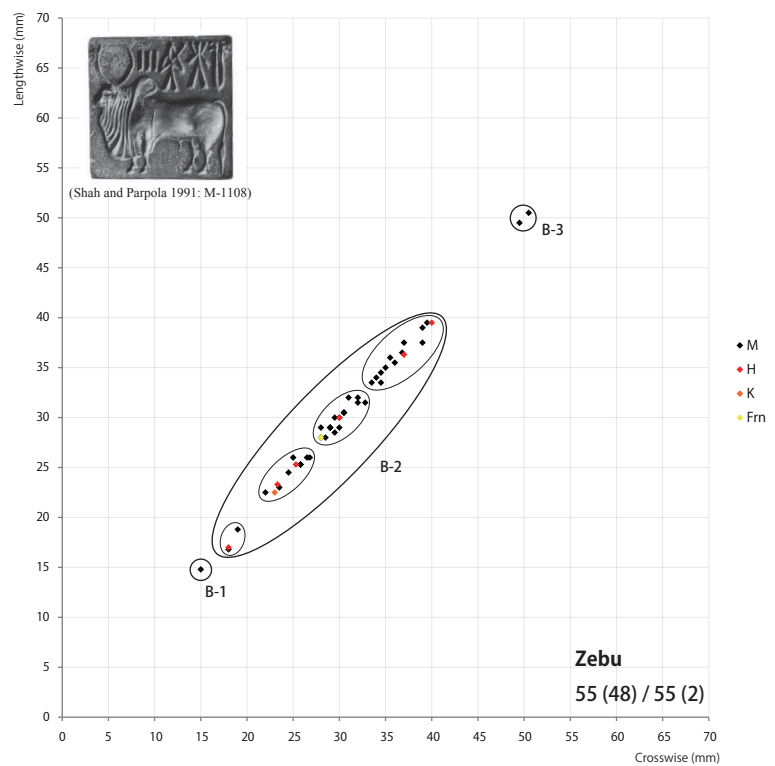
M: Mohenjodaro
H: Harappa
L: Lothal
K: Kalibangan
Dlv: Dholavira
C: Chanfudaro



a

Legend (for Fig. 4.5b)

M: Mohenjodaro
H: Harappa
K: Kalibangan
Frn: Farmana



b

Figure 4.5a & 5b: Scatter plot of the measurement of Harappan seals (5a: Bison, 5b: Zebu)

Seals having a right-facing bison constitute 1.2% or 1 out of 84 seals in which the direction of the head of main motif is clear (i.e. left or right).

ii) Zebu (Figure 4.5b)

Zebu is a humped bull known to be indigenous to South Asia characterized by a fatty hump on shoulder, a large dewlap and long and slender horns (in case of seal motif). The zebu seals constitute 3.0% or 48 out of 1597 seals which their size could be measured (3.1% or 55 out of total of 1783 excavated seals).

Zebu, as well as the goat is also the motif preferred for painting on the pre/ Early Harappan pottery in Balochistan, specifically in Kachi and Quetta regions, e.g. Period ID of Nausharo (Jarrige et al 1995, 2011; Quivron 1994; Samzun 1992). Such preference for pottery design which must have had particular symbolic meaning to the people did not continue in the successive period, but now depicted on seals along with the formation of Harappan Civilization (Konasukawa 2007, 2008a, 2008b).

In many cases, the animals on seals were depicted with their head facing left (thus impressed image will face right), but there are two examples of zebu (M-1106 and H-85) in which its head was depicted facing right (thus impressed image will face left). Seals having a right-facing zebu constitute 3.6% or 2 out of 55 seals which direction of the head of main motif is clear (i.e. left or right). Though such an example is unique, it was excluded from the present analysis because it was partially broken and its size could not be measured (will be discussed in Chapter 5) ⁽⁵⁾.

iii) Elephant (Figure 4.6a)

The elephant motif constitutes 2.3% or 37 out of 1597 seals in which their size could be measured (2.5% or 44 out of the total of 1783 excavated seals). Seals having a right-facing elephant constitute 2.2% or 1 out of 45 seals which direction of the head of main motif is clear (i.e. left or right).

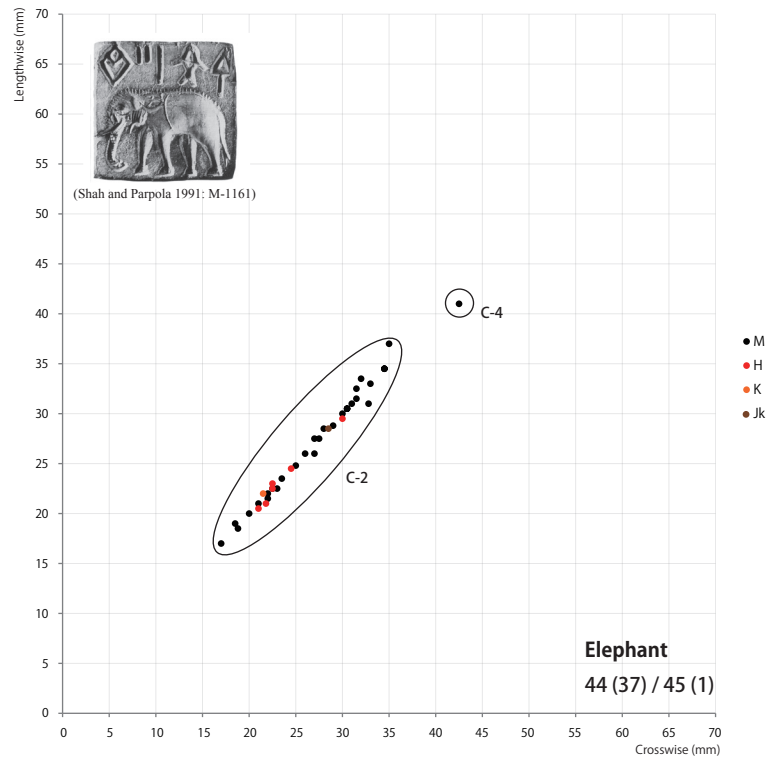
iv) Rhinoceros (Figure 4.6b)

Rhinoceros, along with elephants and tigers do not inhabit the present Indus

Chapter 4

Legend (for Fig. 4.6a)

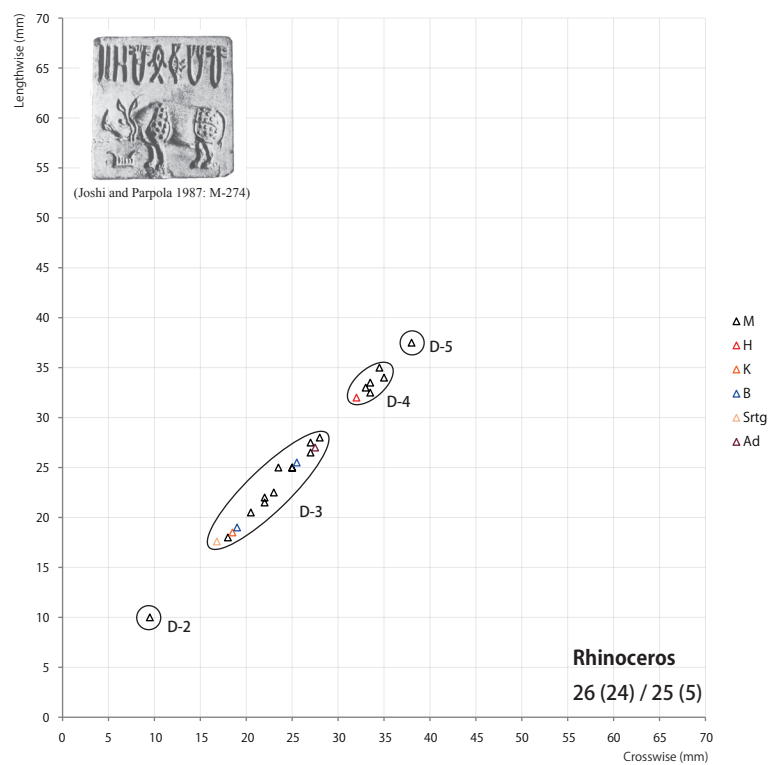
M: Mohenjodaro
H: Harappa
K: Kalibangan
Jk: Jhukar



a

Legend (for Fig. 4.6b)

M: Mohenjodaro
H: Harappa
K: Kalibangan
B: Banawali
Ad: Allahdino
Srtg: Shortugai



b

Figure 4.6a & 6b: Scatter plot of the measurement of Harappan seals (6a: Elephant, 6b: Rhinoceros)

Valley, but their existence during the time of the Harappan Civilization is confirmed by archaeozoological remains as well as terracotta figurines.

The rhinoceros motif constitutes 1.5% or 24 out of 1597 seals where their size could be measured (1.5% or 26 out of the total of 1783 excavated seals). Seals having a right-facing rhinoceros constitute 20% or 5 out of 20 seals in which direction of the head of main motif is clear (i.e. left or right).

v) Goat (Figure 4.7a)

Various kinds of goats differentiated on the basis of horns depicted on seals are grouped together in one category. The different types of horns are: (1) twisted or spiral horns standing upright on head which could be a variety of markhor (e.g. B-8), (2) same twisted horns but spreading horizontally to each side of the head which may be another variety of markhor (e.g. M-271 and B-9), (3) backward-arching horns having knobs which can be either of goat or ibex (antelope) (e.g. M-272, 273 and B-12). These are all part of the animal kingdom of the Indus Valley and its surrounding highland regions of both at the time of the Harappan Civilization as well as at present.

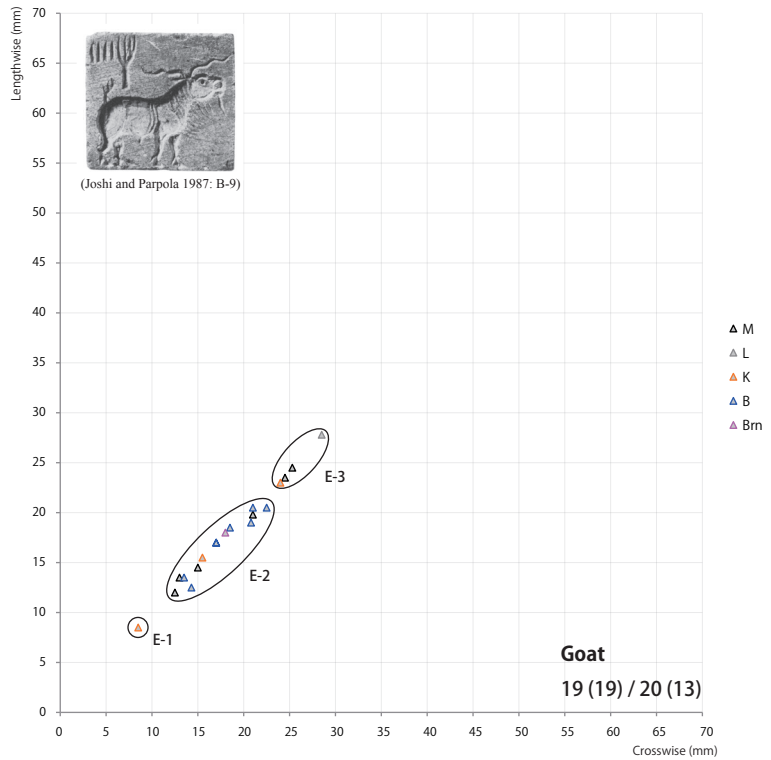
As far as the direction of head is concerned, goat motifs are always depicted with the head facing right (thus the impressed image will face left), in contrast with the majority of animal motifs which faces left (thus impressed image faces right). Seals having a right-facing goat constitute 65% or 13 out of 20 seals where the direction of the head of main motif is clear (i.e. left or right). Such distinctive features may simply indicate that they belong to a chronologically different phase from the others (perhaps to early phase) or regional variation (Konasukawa 2007, 2011b), but it can also be presumed that direction of head may signify certain mythological, religious or symbolic meanings for the owner of the seals. In connection with this, it can be pointed out here that a few of them are known to have their head turning backward, which also suggest similar explanation (Kondo 2006).

The goat motif constitutes 1.2% or 19 out of 1597 seals which their size could be

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Legend (for Fig. 4.7a)

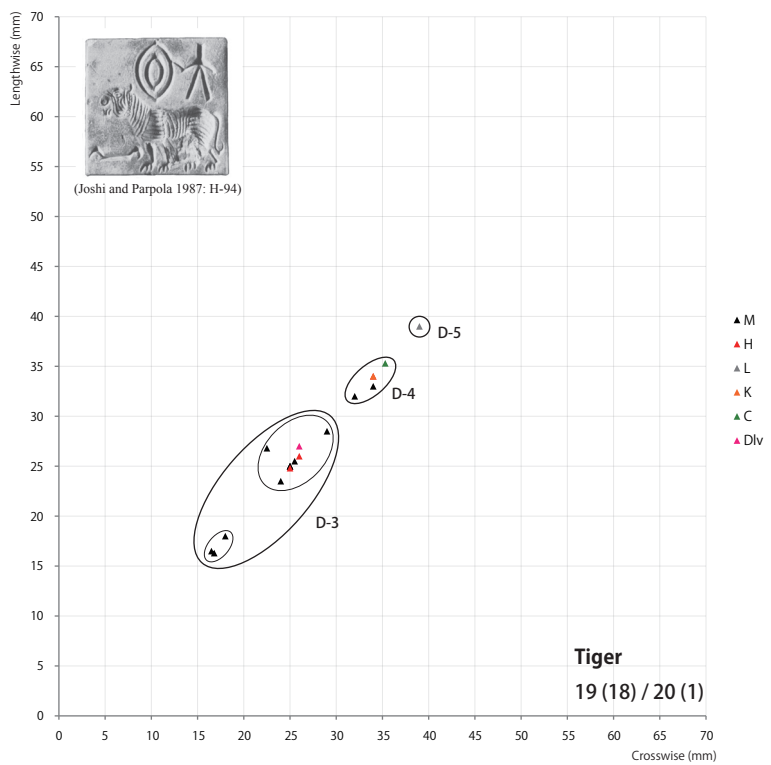
M: Mohenjodaro
L: Lothal
K: Kalibangan
B: Banawali
Brn: Bhirrana



a

Legend (for Fig. 4.7b)

M: Mohenjodaro
H: Harappa
L: Lothal
K: Kalibangan
Dlv: Dholavira
C: Chanfudaro



b

Figure 4.7a & 7b: Scatter plot of the measurement of Harappan seals (7a: Goat, 7b: Tiger)

measured (1.1% or 19 out of total of 1783 excavated seals).

vi) Tiger (Figure 4.7b)

The tiger motif constitutes 1.1% or 18 seals out of 1597 seals in which their size could be measured (1.1% or 19 out of the total of 1783 excavated seals). Seals having a right-facing tiger constitute 5% or 1 out of 20 seals which direction of head of main motif is clear (i.e. left or right).

vii) Buffalo (Figure 4.8a)

Water buffalo has long curved horns in shape of crescents, projecting horizontally towards both sides of head. Ribs on horns are also characteristic features of water buffalo. It is usually depicted with manger, but unlike the bison, the head of water buffalo is held high.

The buffalo motif constitutes 0.9% or 15 out of 1597 seals where their size could be measured (1% or 17 out of total of 1783 excavated seals). Seals having a right-facing buffalo constitute 37.5% or 6 out of 16 seals which direction of head of main motif is clear (i.e. left or right).

viii) Other bovine (urus) (Figure 4.8b)

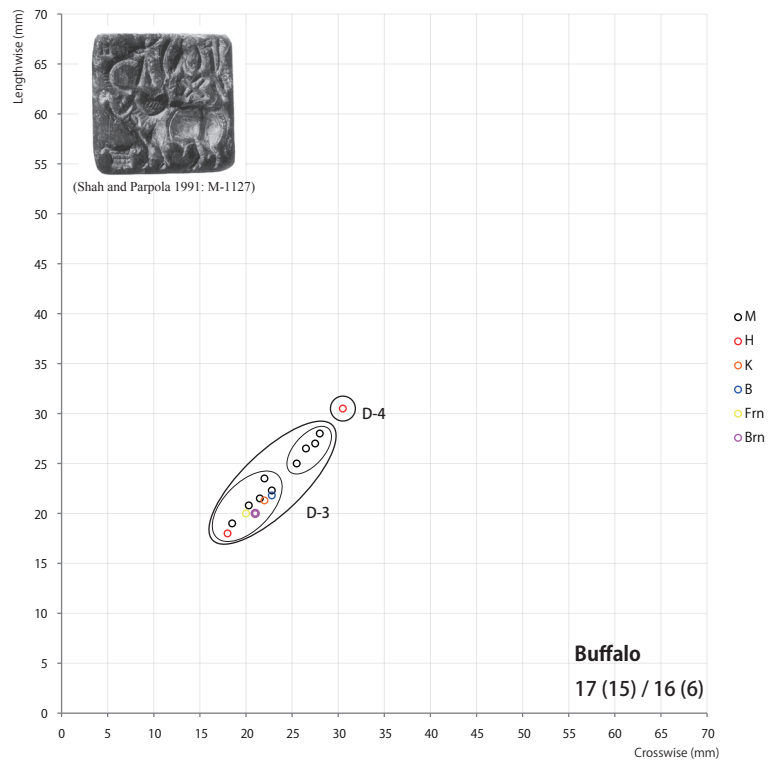
This is a group classified as ‘urus’ in *the CISI* (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991), though it does not specifically indicate urus or auroch species of cattle. Their body is identical with that of the unicorn. The ‘ritual offering stand’ which is typical to the unicorn is also depicted in front of this animal, but it has two horns. Two kinds of horns are depicted on these animals: (a) front-arching horns (e.g. M-233) and (b) long and slender horns like that of zebu (e.g. M-232). It is most likely that this animal had close mythological or religious relations with unicorn.

This motif constitutes 0.4% or 7 out of 1598 seals which their size could be measured (0.4% or 8 out of total of 1784 excavated seals). Seals having a right-facing other bovine (urus) constitute 50% or 4 out of 8 seals which direction of head of main motif is clear (ie. left or right).

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Legend (for Fig. 4.8a)

M: Mohenjodaro
H: Harappa
K: Kalibangan
B: Banawali
Frn: Farmana
Brn: Bhirrana



Legend (for Fig. 4.8b)

M: Mohenjodaro
K: Kalibangan
B: Banawali
Blk: Bala kot

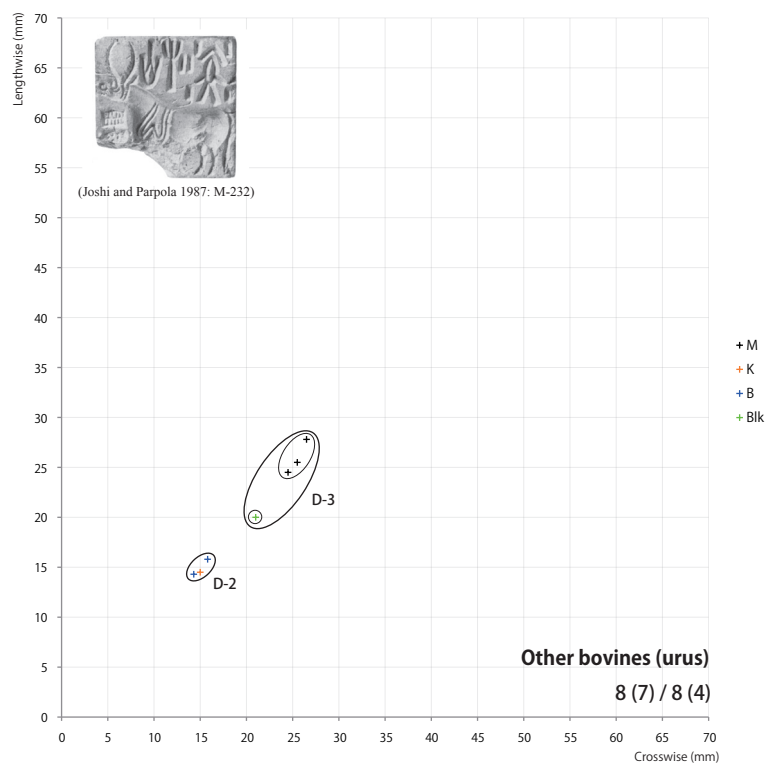


Figure 4.8a & 8b: Scatter plot of the measurement of Harappan seals (8a: Buffalo, 8b: Other bovines_urus)

ix) Gharial (Indian gavial) (Figure 4.9a)

Gharial is a kind of crocodile with long and narrow jaws living in rivers of Indus and Ganges. This motif constitutes 0.1% or 2 seals out of 1597 seals which their size could be measured (0.1% or 2 out of total of 1783 excavated seals). The heads of main motif of these two examples face right. Two examples (M-292 and 293) are excavated from Mohenjodaro.

x) Wild ass

Only one example is discovered from Kanmer (Kharakwar et al. 2012: Seal No-1, Parpola and Janhunen 2011).

xi) Rabbit

Only one example (H-95) is found from Harappa, but unfortunately the seal is broken in half and its size could not be measured.

xii) Bird

Only one example (L-50) is found from Lothal, but the seal is broken and its size could not be measured.

I-B. Imaginary animals and deity

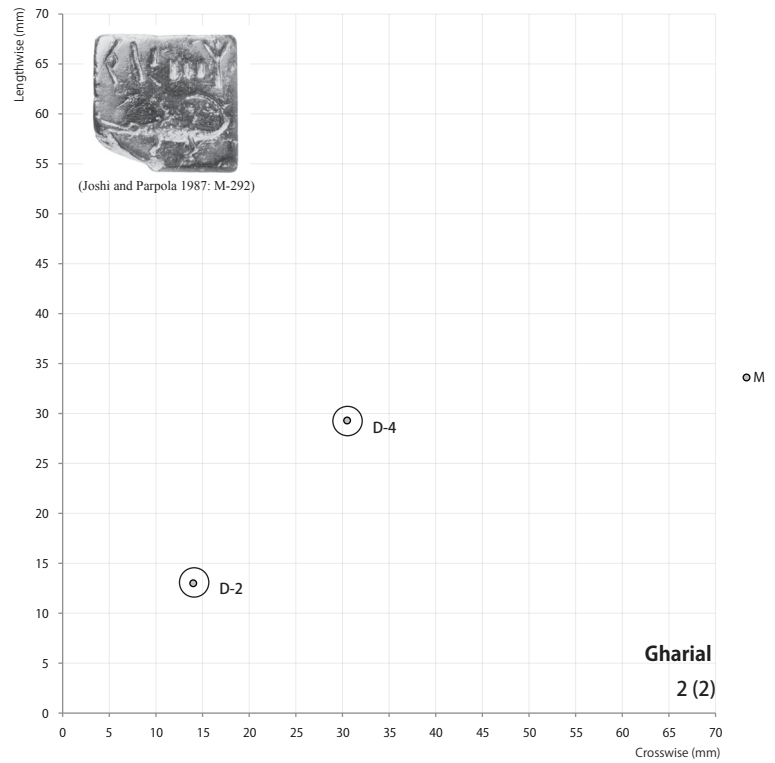
Motifs included in this category are imaginary animals such as unicorns, composite animals having various parts of different animals, multi-headed animals having three heads of different animals, horned tigers and elephants. Another important motif is so called ‘horned deity’, a body of a human figure with huge buffalo horns on its head (it could also be a priest or a shaman wearing horned head gear).

i) Unicorn (Figures 4.9b and 4.10)

This is a bovine type of animal having only one horn, unique to Harappan seals, depicted along with so-called ‘ritual offering stand’ in front of it. The single horn cannot be considered as a depiction of side view of two horns overlapping each other, since in case of other animals having two horns, both are clearly depicted (head and body is depicted lateral view, whereas the horns are of frontal view). There are

Legend (for Fig. 4.9a)

M: Mohenjodaro

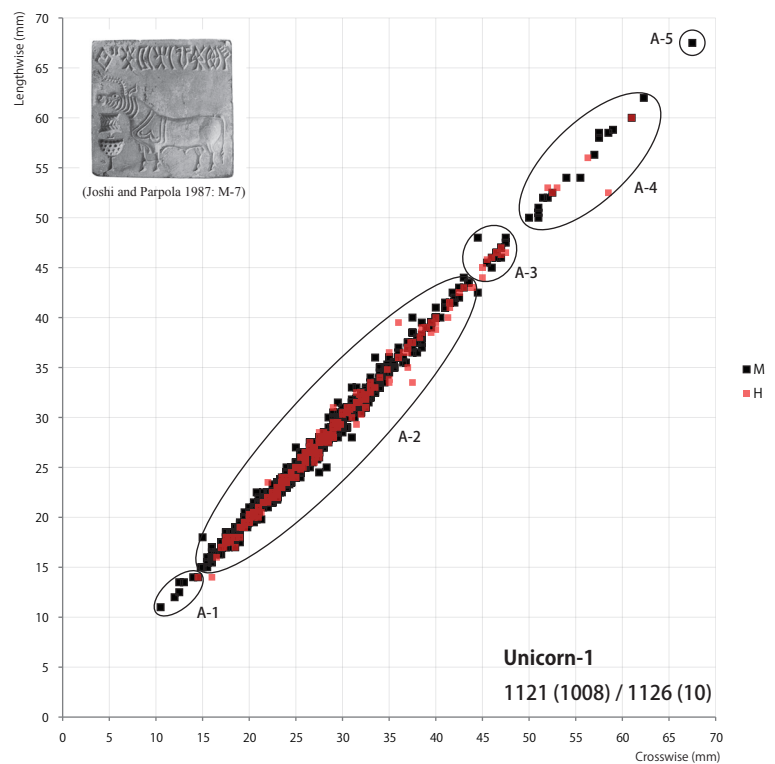


a

Legend (for Fig. 4.9b)

M: Mohenjodaro

H: Harappa



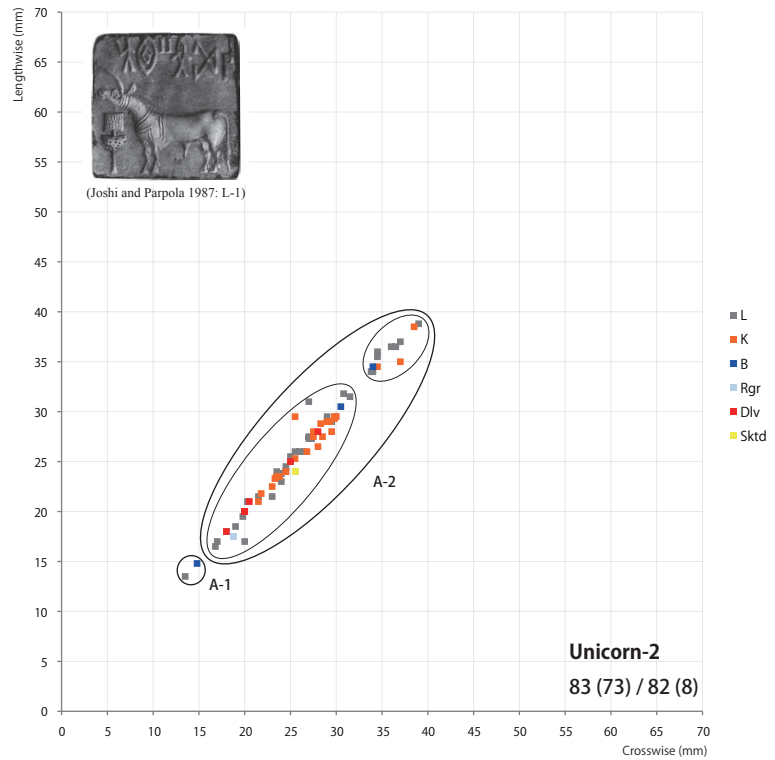
b

Figure 4.9a & 9b: Scatter plot of the measurement of Harappan seals (9a: Gharial, 9b: Unicorn-1)

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Legend (for Fig. 4.10a)

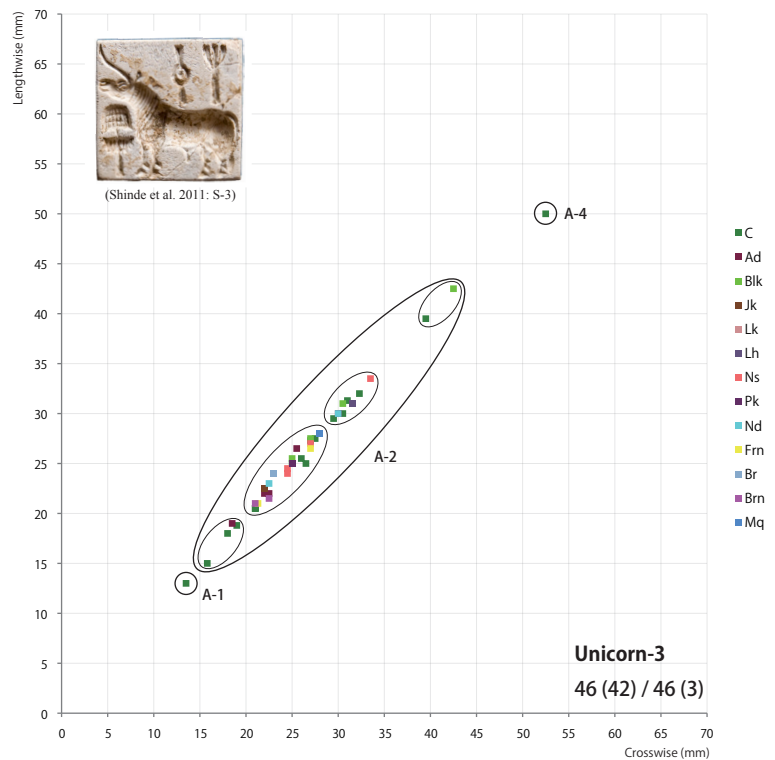
L: Lothal
K: Kalibangan
B: Banawali
Rgr: Rakhigarhi
Dlv: Dholavira
Sktd: Surkotada



a

Legend (for Fig. 4.10b)

C: Chanfudaro
Ad: Allahdino
Blk: Bala kot
Jk: Jhukar
Lk: Lakhanjodaro
Lh: Lohumjodaro
Ns: Nausharo
Pk: Pirak
Nd: Nindowari
Frn: Farmana
Br: Baror
Brn: Bhirrana
Mq: Miri Qalat



b

Figure 4.10a & 10b: Scatter plot of the measurement of Harappan seals (10a: Unicorn-2, 10b: Unicorn-3)

terracotta figurines of unicorns also.

Among the entire collection of seals, the unicorn motif constitutes 70.3% or 1123 out of total of 1597 seals which their size could be measured (70.1% or 1250 out of total of 1783 excavated seals). Such high percentage of the unicorn motif is the most distinctive characteristic of the Indus seals, whereas the rest of the motifs constitute only around 1 to 5%, the majority being below 1%. Quite a number of motifs have only a few, or even only one excavated example. Seals having a right-facing unicorn constitute 1.7% or 21 out of 1254 seals which direction of head of main motif is clear (i.e. left or right).

Based on scatter plot of figure 4.9b, the majority of the seals are cut accurately into square shape, and margin of error usually does not exceed 0.5mm.

ii) Composite animal (Figure 4.11)

This is an animal having various parts of different animals and human being.

a. Animal with combination of horns of zebu, elephant tusk, human face, body of goat, hind legs of tiger and tail in form of snake (e.g. M-300). There are 17 examples.

b. Horned tiger: This is a tiger having long and slender horns like that of zebu. Two examples are discovered from Mohenjodaro (M-1168) and Banawali (B-17).

These motifs (a and b) constitute 0.9% or 14 seals out of 1597 seals which their size could be measured (1.1% or 19 out of total of 1783 excavated seals). Seals having a right-facing composite animal constitute 5.3% or 1 out of 19 seals which direction of head of main motif is clear (i.e. left or right).

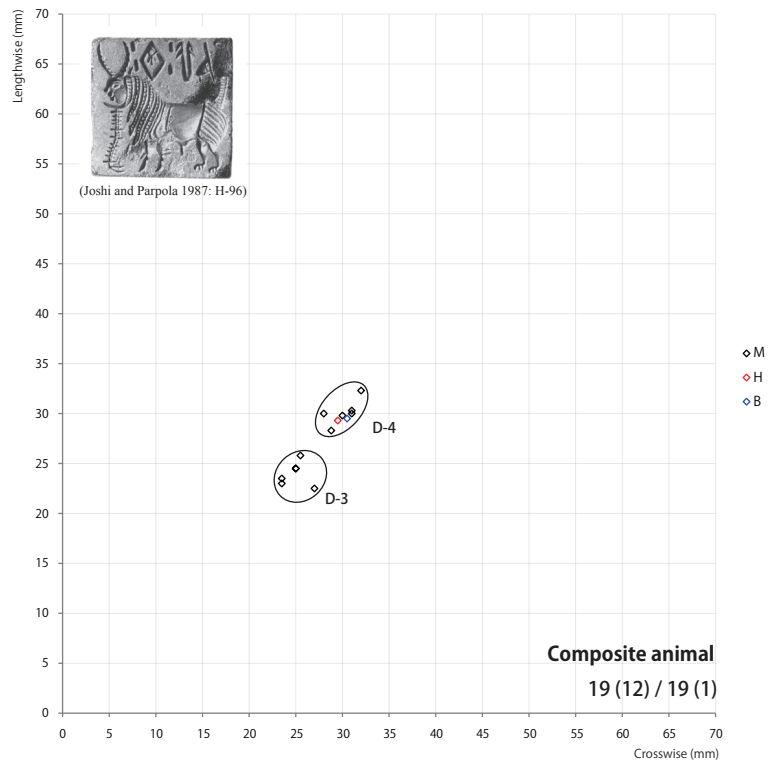
c. Horned elephant: This is an elephant having long and slender horns like that of zebu. However, only one example of its impression on a sealing (K-85) is found from Kalibangan, and the actual seal is yet to be found.

d-1. Horned deity-A: A human figure with buffalo horns on its head is commonly referred as 'horned deity' who characterizes the Harappan Civilization. Whether it is male or female cannot be determined from its features. The figure itself may have

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Legend (for Fig. 4.11a)

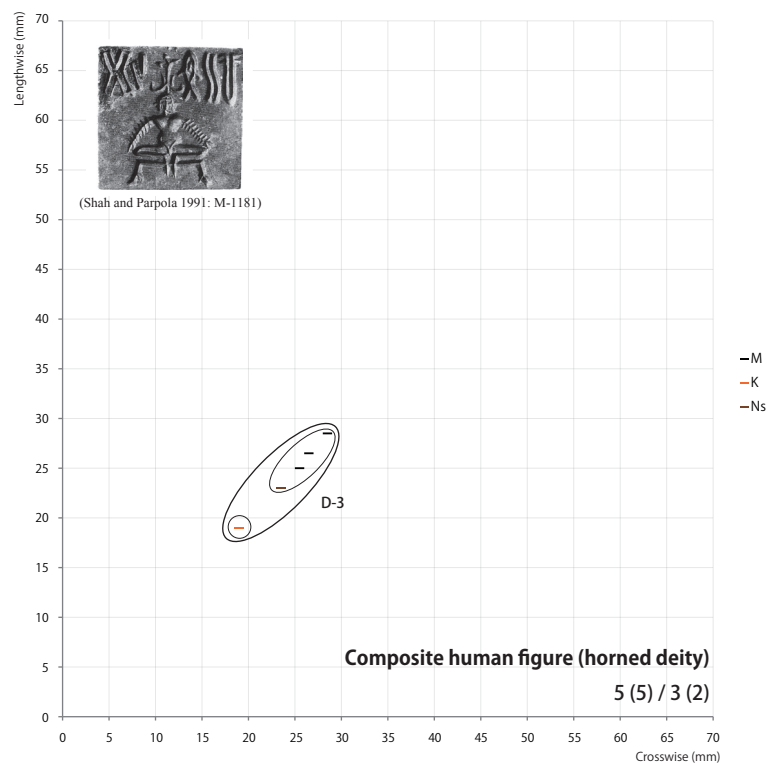
M: Mohenjodaro
H: Harappa
B: Banawali



a

Legend (for Fig. 4.11b)

M: Mohenjodaro
K: Kalibangan
Ns: Nausharo



b

Figure 4.11a & 11b: Scatter plot of the measurement of Harappan seals (11a: Composite animal, 11b: Composite human figure_horned deity)

been a deity, but it is also possible that it is a priest or shaman wearing head gear with horns. Like other motifs, the horned deity-A is also depicted either singularly or with other figures in groups. Only two examples of horned deity depicted singularly (M-305 and 1181) are known (both from Mohenjo-daro), both sitting in so called yogic posture, and one of the examples is seated on a pedestal (M-1181).

d-2. Horned deity-B: This is a human figure having the wavy horns of goat (markhor) and the body and hind legs of a tiger attached to its hip (M-311, K-50 and Ns-9). A plant is sprouting between the horns and the figure has a long draping hair and wearing long skirt tied around its waist. It has a similarity with the 'Centauros' or Centaur of ancient Greece, but where the Centauros only possesses the upper portion of the human body attached above the horse's shoulder, in case of this horned figure, the entire human body down to its feet is depicted.

These motifs (d-1 and d-2) constitute 0.3% or 4 seals out of 1597 seals in which their size could be measured (0.3% or 5 out of total of 1783 excavated seals). Seals having a right-facing horned deity constitute 66.6% or 2 out of 3 seals which direction of head of main motif is clear (i.e. left or right).

It is a common argument that horned deity-A and B (whatever it may have been – either god or human priest) has played an important role for uniting the Indus society in terms of religion as well as politics (Allchin and Allchin 1987, 1997; Kondo 2006). The owner of the horned deity seal may have been a man of high rank in the society.

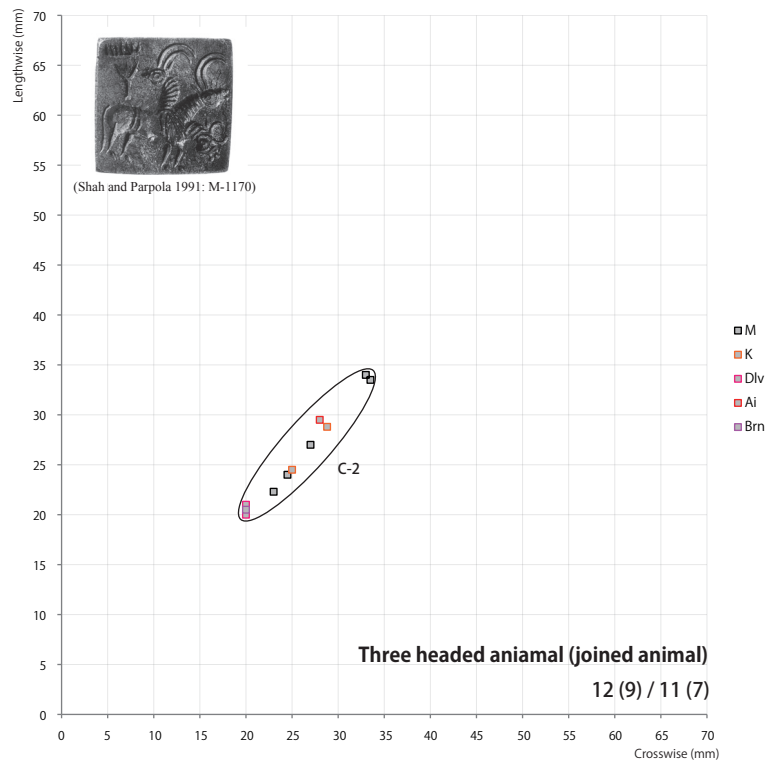
iii) Three headed animal (Figure 4.12a)

The multiple-headed or conjoined animal has one body with three heads of different animals. These are usually a bovine like animal having front-arching horns with its head looking back, a unicorn, and a bison with its head bent down towards ground but without man. Combination of three animals may vary in some cases. All these animals also appear individually on other seals. Some seals have no depiction of Indus script.

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Legend (for Fig. 4.12a)

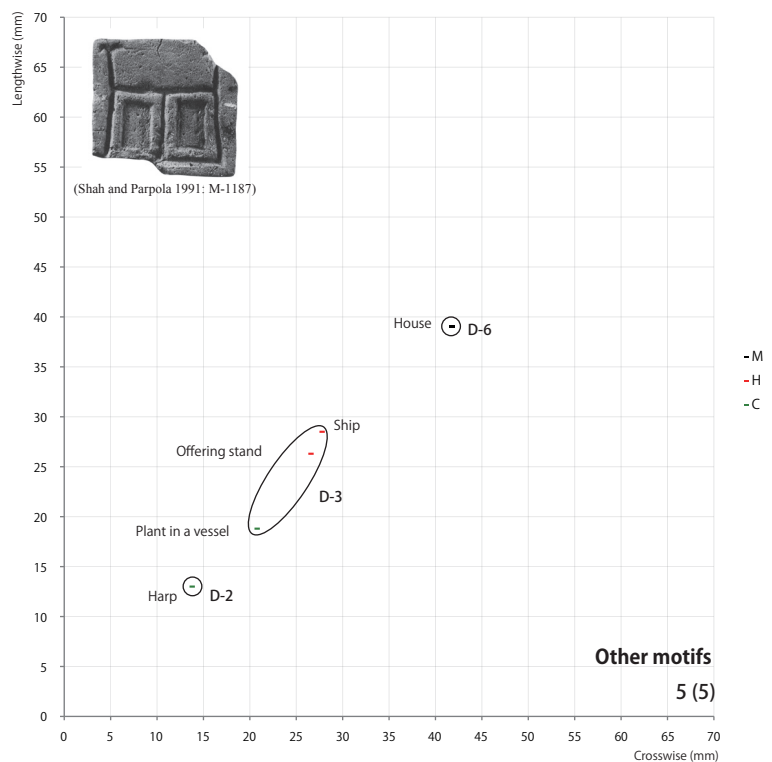
M: Mohenjodaro
K: Kalibangan
Dlv: Dholavira
Brn: Bhirrana
Ai: Amri



a

Legend (for Fig. 4.12b)

M: Mohenjodaro
H: Harappa
C: Chanfudaro



b

Figure 4.12a & 12b: Scatter plot of the measurement of Harappan seals (12a: Three headed animal, 12b: Other motifs)

The heads of the unicorn and bison (which are facing forward) faces right as in the case of goat, which is again significant. Seals having a right-facing multi-headed animal constitute 63.6% or 7 out of 11 seals which direction of head of main motif is clear (i.e. left or right).

It can also be noted that eyes of each animals are depicted with large circles, covering entire face portion. Such design has a close similarity with the painted animal motifs of Kulli culture of Balochistan, suggesting certain cultural interactions (Konasukawa 2007; Kondo et al. 2007).

The multi-headed animal constitutes 0.7% or 11 seals out of total of 1597 seals which their size could be measured (0.7% or 12 out of 1783 excavated seals).

I-C. Other motifs (Figure 4.12b)

These motifs constitute 0.3% or 5 seals out of 1597 which their size could be measured (0.3% or 5 out of total of 1783 excavated seals).

i) House, or some kind of building (M-1187)

ii) Plant in a vessel (C-28)

iii) Offering stand (or staff) (H-98)

iv) Ship (H-99)

v) Harp (C-26)

vi) Other identified motifs

Examples having an unidentified motif (e.g. Ad-8) are lumped together as Other identified motifs. These motifs constitute 0. 1% or 17 out of total of 1783 excavated seals. Seals having a right-facing other identified motif constitute 30.8% or 4 out of 13 seals which direction of head of main motif is clear (i.e. left or right).

3-II. Group motifs

These are motifs depicting two or more figures of human or horned deity-A or C, animals, plants or combination of either/all of them. These can be called narrative scenes of certain mythology or story. Only one or a few seals are found for each motif

or scene. The following motifs are included in this category.

II-A. Real animals and figures

Human figure (s) and animal (s) (Figure 4.13a)

Motifs include here are: a human figure holding 2 tigers (M-306); a tiger looking back at a kneeling figure on a tree branch (M-309); a buffalo throwing up 5 human figures into the air (M-312 and NHK and NHK Promotion 2000-335: these human figures may have been an expression of continuous movement of only one human thrown into the air and falling towards back of the buffalo); a human figure with a three headed animal (NHK and NHK Promotion 2000-339); and an example from Chanhudaro (Mackay 1943: Plate LI-13). It is worth mentioning here about the example from Chanhudaro, of what may have been a similar female figure having small pointed ears instead of horns lying on its back and bull with an erect penis hovering over her (Mackay 1943: Plate LI-13). This has been interpreted as union of heaven and earth by Allchin (Allchin 1985). It is not clear whether this can also be grouped under horned deity, but may have had connection with the horned female figure attacking horned tiger.

The human figure (s) and animal (s) constitutes 0.9% or 15 seals out of total of 1597 seals where their size could be measured (0.9% or 16 out of 1783 excavated seals).

II-B. Imaginary

i) Horned deity (deities) –A with either human figure (s), or animal (s) and plant (s) (Figure 4.13b)

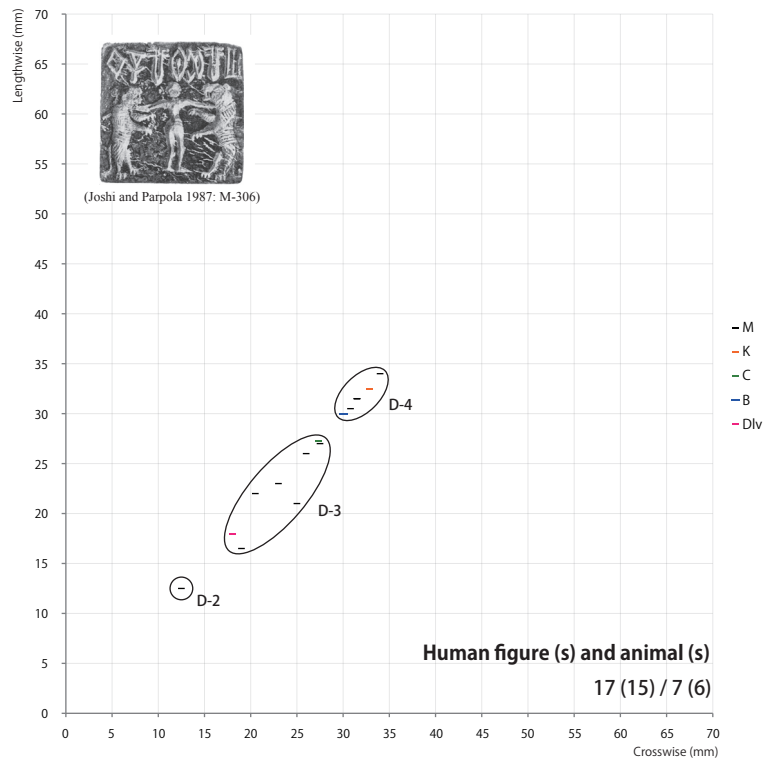
There are only a few examples of horned deity-A, and they can be subdivided into following three:

(a) This is the so-called ‘Pashupati’ motif (the lord of animals). The horned deity-A is sitting on a pedestal with its legs folded in a yogic posture surrounded by rhinoceros, buffalo, elephant, tiger and goat (perhaps one more goat on broken portion). Only one

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Legend (for Fig. 4.13a)

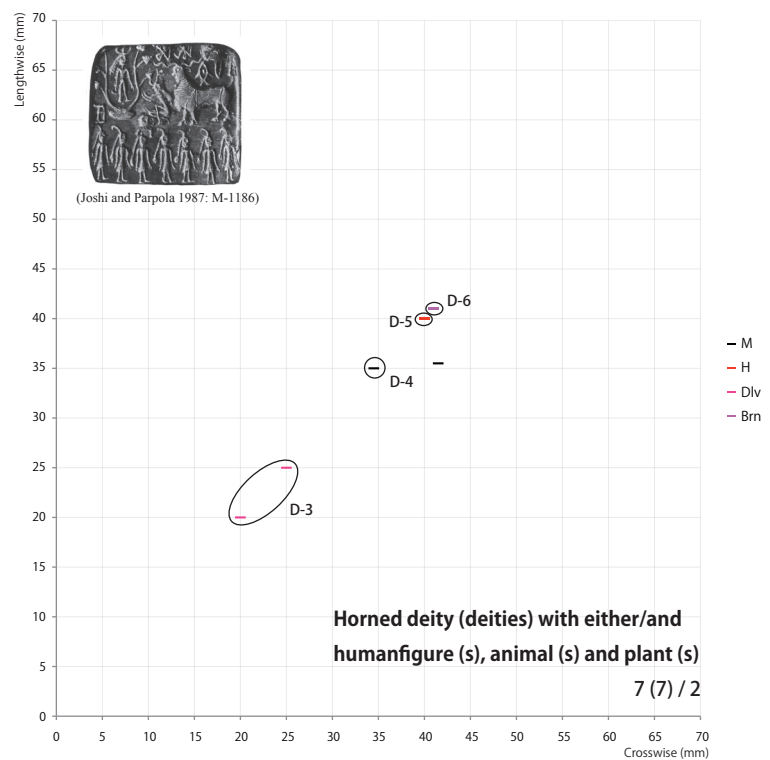
M: Mohenjodaro
K: Kalibangan
B: Banawali
Dlv: Dholavira
C: Chanfudaro



a

Legend (for Fig. 4.13b)

M: Mohenjodaro
H: Harappa
Dlv: Dholavira
Brn: Bhirrana



b

Figure 4.13a & 13b: Scatter plot of the measurement of Harappan seals (13a: Human figure(s) and animal(s), 13b: Horned deity (deities) with either/and human figure(s), animal(s) and plant(s))

example (M-304) is found from Mohenjodaro.

(b) Horned deity-A standing in between two trees. Only one example (NHK and NHK Promotion 2000-337) of this motif is found from Dholavira. Its technique of engraving is rough and much of its detail of face or body features etc. is omitted. It was most probably made locally.

(c) This is the motif so called 'ritual scene'. One horned deity-A is standing inside a pipal tree which is being worshipped by another horned deity-A kneeling in front of the tree. In front of this kneeling horned deity-A is what seems to be a human head placed on a small pedestal (as sacrifice ?). A composite animal (which has the horns of a goat, a human face and the body of either goat or bovid) is shown standing behind the kneeling horned deity-A. At the bottom portion of the scene is a line of seven human figures sometimes referred as 'Saptamatrikas'. Only one complete example (M-1186) is known, and the other one (H-97) is of a broken piece (only a portion of seven human figures remains). The former is from Mohenjodaro, the latter is from Harappa.

(d) One horned deity-A is standing inside a pipal tree which is being worshipped by another human figure kneeling in front of the tree and an unidentified horned-animal (NHK and NHK Promotion 2000-334).

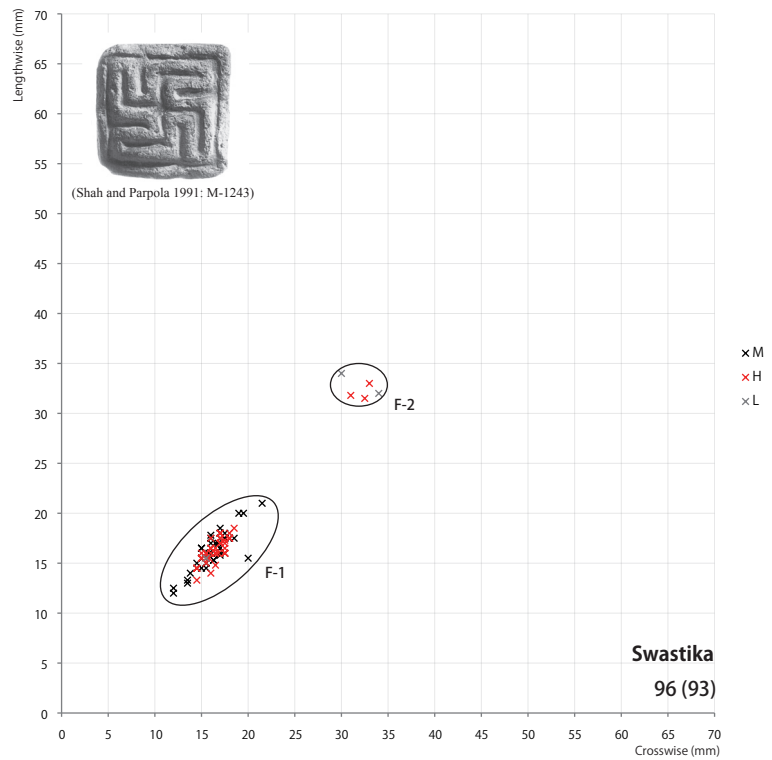
(e) This is a human-like figure with (buffalo ?) horns, with clear depiction of breasts (Horned deity-C). Only one example is known (M-1919), where this female figure is attacking a horned tiger. The female figure seems to have hooves on its four limbs as well as long tail on its hip.

(f) One horned deity-A is standing at the back of a three headed animal (Rao et al. 2005: Plate. 10).

The horned deity (deities)-A with either/and human figure (s), animal (s) and plant (s) constitutes 0.4% or 7 seals out of total of 1597 seals which their size could be measured (0.4% or 7 out of 1783 excavated seals).

Legend (for Fig. 4.14a)

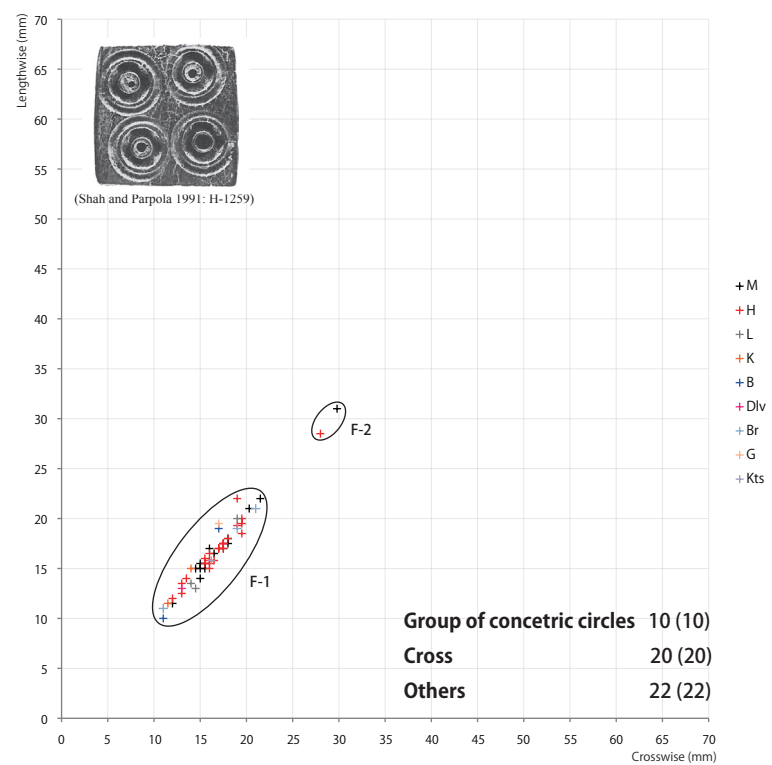
M: Mohenjodaro
H: Harappa
L: Lothal



a

Legend (for Fig. 4.14b)

M: Mohenjodaro
H: Harappa
L: Lothal
K: Kalibangan
B: Banawali
Dlv: Dholavira
Br: Baror
G: Gumla
Kts: Kuntasi



b

Figure 4.14a & 14b: Scatter plot of the measurement of Harappan seals (14a: Swastika, 14b: Group of concentric circles, cross and others)

ii) Animal s with plant

This is a pipal tree sprouting from joined heads of two unicorns. The sole example (M-296) is from Mohenjodaro.

iii) Animals in group

This is a half broken seal with unicorn (?) and elephant (?) seal from Mohenjodaro (M-294).

3-III. Geometric motifs (Figure 4.14)

In this category of seals, only geometric motifs are depicted, devoid of any concrete objects or script. Shape of boss on reverse side is small cylindrical or square that is different from other seals with animal motifs etc. Such features indicate that these seals were owned by an entirely different group of people (perhaps even of foreign origin) from that of owners of animal motifs etc.

III-A. Swastika

III-B. Group of Concentric circles (M-1259)

III-C. Cross with concentric circles (M-352 and H-638)

III-D. Others (e.g. M-351, 1255 and H-637)

The swastika constitutes 5.8% or 93 seals out of 1597 in which their size could be measured (5.4% or 96 out of total of 1783 excavated seals).

And other geometrical motifs (III-B, C and D) constitute 3.3% or 52 seals out of 1597 where their size could be measured (2.9% or 52 out of total of 1783 excavated seals). Motif of group of concentric circles is found from Mohenjodaro, Harrappa, Kalibangan, Bhirrana and Dholavira whereas cross motif is found only from Mohenjodaro, Harappa and Lothal. Many of them are concentrated at Harappa.

3-IV. Only scripts (Figure 4.15)

These are seals with only scripts (signs) engraved on surface. The number of scripts range from only one (M-1198) up to maximum of 17 in three lines (M-314). This category of seals constitutes 1.3% or 21 seals out of 1597 in which their size could be

Legend (for Fig. 4.15)

M: Mohenjodaro
H: Harappa
L: Lothal
K: Kalibangan
B: Banawali
Sktd: Surkotada
Ad: Allahdino

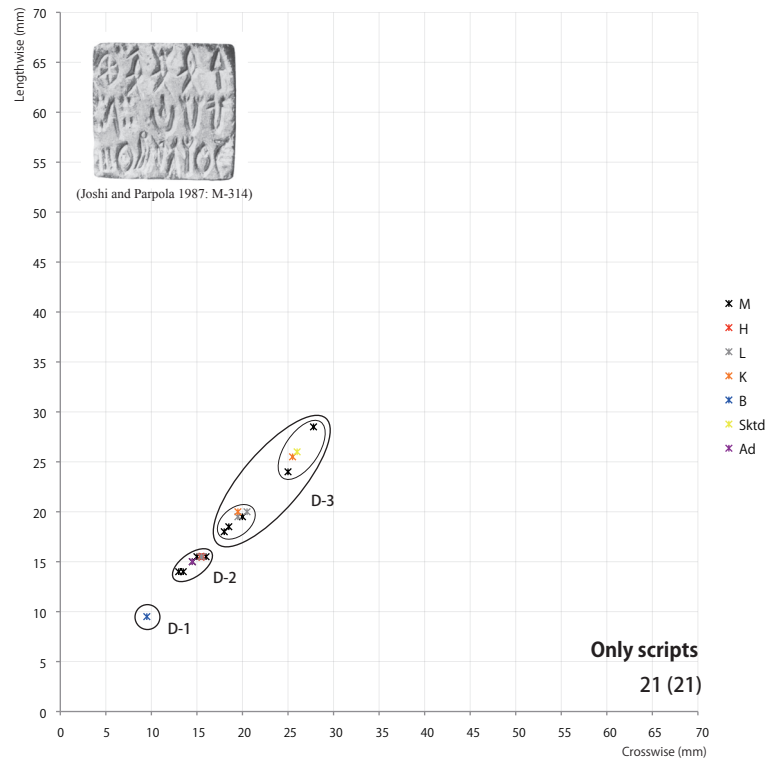


Figure 4.15: Scatter plot of the measurement of Harappan seals (Only scripts)

measured (1.2% or 21 out of total of 1783 excavated seals). Only those which are considered as finished seals are included here.

4. Size Category and Regional Variation of the Harappan seals

4-I. Size Category

Based on size measurement of each seal having same motifs (Figures 4.5 to 4.15), an effort was made to reconstruct the size categorisation of the Harappan seals. As a conclusion, the present data shows that there seems to be no single rule which classifies all the seals into size categories. Based on the motifs and their size distribution as shown in Figure 4.16, it was possible to broadly classify the seals into five major groups namely A, B, C, D and E.

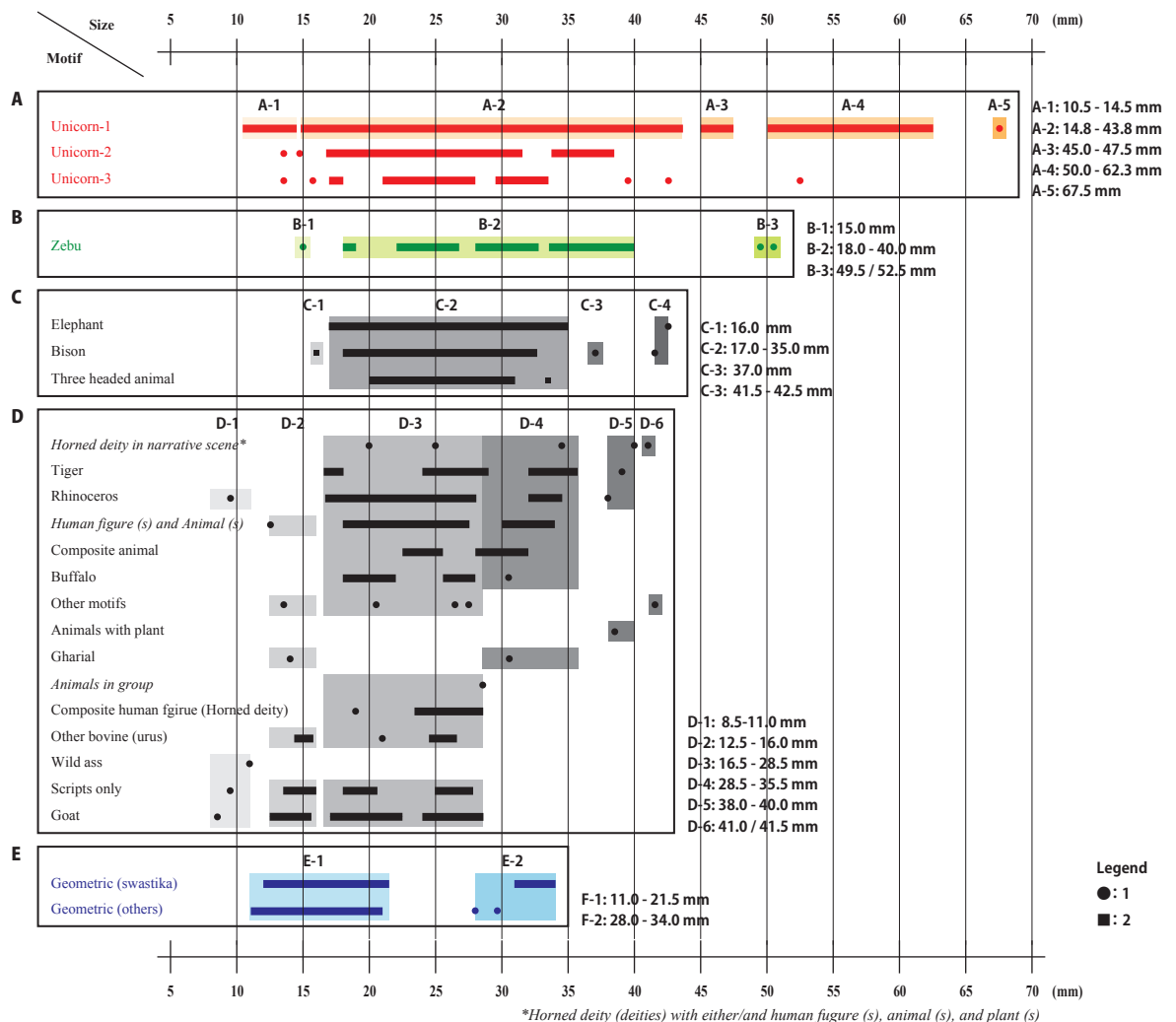


Figure 4.16: Size categorization of the Harappan seals

I-A. Group A

This is the group having wide range of size distribution, classified into five categories namely A-1, 2, 3, 4 and 5. Only unicorn seals are included in this group. As stated earlier, the unicorn seals alone constitute 70.3% of all the seals (1123 out of total of 1597 seals) and because of such a large amount, they are tentatively classified into following three sub-groups (Figures 4.9b and 4.10):

Unicorn-1 (Figure 4.9b): those found from the two major urban sites of Mohenjodaro and Harappa. Total of 1008 examples.

Unicorn-2 (Figure 4.10a): those found from six smaller urban sites - Dholavira, Lothal, Surkotada, Kalibangan, Banawali and Rakhigarhi. Total of 73 examples.

Unicorn-3 (Figure 4.10b): Those found from twelve smaller sites throughout the Indus territory. Total of 42 examples.

Group A or the unicorn seals has the widest range of size unrivalled by any other motifs. These could be tentatively classified into five categories based on size distribution:

A-1: 10.5 - 14.5 mm

A-2: 14.8 - 43.8 mm

A-3: 45.0 - 47.5 mm

A-4: 50.0 - 62.3 mm

A-5: 67.5 mm (only one example from Mohenjodaro, M-1203)

Unicorn-1: In spite of wide range of size distribution, categories A-1, A-2 and A-3 specifically, were rather difficult to set up as separate categories because there is no clear division in between. The gap is merely a few millimeters or even less in some cases. However, careful comparison with all the other groups suggests there is a tendency to set up smaller as well larger categories separately. On the other hand, A-2 could not be subdivided further in spite of wide range of size distribution. Perhaps the possibility of more categorization is masked by a large margin of error, but at the same time, this indicates that there was no strict size categorization that had to be followed.

The unicorn seals are the only group/seal that has seals larger than (around) 50 mm, except two (49.5 and 50.5 mm in size respectively, the former is M-1101 and the latter is M-256) zebu seals of the largest category of Group B (B-3). The size of A-5 is astounding and it is easy to speculate that the owner of this seal must have been a person of highest rank among all the seal bearers. Owners of the smallest category (A-1) must have also had their role to play. It is most likely that difference of size reflects commercial or economical importance of the seal themselves and therefore of their

owners. A-5 is found only from Mohenjodaro.

Unicorn-2: Among the unicorn seals from six smaller urban sites, sizes corresponding to only A-1 and A-2 are found. It has to be noted that no seal larger than 40 mm is found from these sites. The seals corresponding to A-2 seem to be classified into at least two size categories. However, their size distribution does not match with unicorn-3. It may be possible that this categorization was followed only at smaller urban sites.

Unicorn-3: These are found from twelve small sites from almost all the regions of the Harappan Civilization except Punjab, Gujarat and Gommal Plain. It is noteworthy that finds of a few unicorn seals from Kachi Plain (Nausharo, Pirak), Balochistan (Nidowari) and Makran (Miri Qalat). Except in rare cases, the unicorn seals are the only seal which are reported from these peripheral regions.

The size distribution of the seals from various small sites corresponds with A-1, A-2 and A-4. The majority of the seals fall into A-2 which may have had several categories though as stated above, do not exactly match with the seals of unicorn-2.

The sole example of A-4 (C-1) is the seal from Chanhudaro. Beside Mohenjodaro and Harappa, Chanhudaro is the only site among all the sites of the Harappan Civilization where such large unicorn seal is recorded. Obviously this indicates the importance of this site as carnelian bead manufacturing center (Mackay 1943), and also its crucial location close to Mohenjodaro. The owner of this large unicorn seal must have been posted at this site to supervise carnelian trade.

I-B. Group B

Only the zebu seals are included in this group (Figure 4.5b). These seals are confined only to four sites of Mohenjodaro, Harappa, Kalibangan and Farmana, and none is reported from south of Mohenjodaro. Total of 48 examples are found. Their sizes can be broadly classified into three categories:

B-1: 15.0 mm

B-2: 18.0 - 40.0 mm

B-3: 49.5 / 52.5 mm

B-2 may have been classified further into four categories but this is yet to be confirmed. Category B-3 is very large size unmatched with any other seals except the unicorn. Although only two examples (M-256 and 1101) both from Mohenjodaro are found, this fact indicates an importance of zebu motif next to the unicorn. Sole example of the smallest category B-1 (M-265) is also from Mohenjodaro.

I-C. Group C

The seals having motifs of either elephant, bison and multi-headed animal are included in this group. Whole group is classified into four categories of C-1, C-2, C-3 and C-4 showing high concentration between 17.0 - 40.0 mm. C-2 could not be clearly subdivided further but otherwise, there is no distinct difference between Group D. Group as a whole, their sizes can be classified into following categories:

C-1: 16.0 mm

C-2: 17.0 - 35.0 mm

C-3: 37.0 mm

C-4: 41.5 - 42.5 mm

Elephant (Figure 4.6a): Total of 37 examples are classified into categories C-2 and 4. Except sole example of C-4 (M-1156) from Mohenjodaro, all the rest of the seals form a concentration in C-2. The majority of these seals are from Mohenjodaro, with a few examples from Harappa and Kalibangan and one from Jhukar. The finds of elephant seals are also confined to these four sites only and unreported from the south of Mohenjodaro.

Bison (Figure 4.5a): A total of 79 examples are classified into four categories of C-1, C-2, C-3 and C-4, though again the majority is confined to C-2. Only three examples (M-255, H-583 and 584) are from Mohenjodaro and Harappa for C-1, and only one example each from Mohenjodaro for C-3 (M-235) and C-4 (M-234). The rest of the seals of C-2 are from Chanhudaro, Lothal, Dholavira and Kalibangan. It is noteworthy

that some of the bison seals are from Gujarat region.

Three headed animal (Figure 4.12a): Total of 11 examples are all classified as C-2 only. These are found from five sites of Mohenjodaro, Amri, Dholavira, Kalibangan and Bhirrana. So far none is found from Harappa. Though the number is very much restricted, the three headed animal seals are found from wide regions.

I-D. Group D

Total of fifteen various motifs are included in this group. As stated earlier, broad classification of categories is similar with group C. The sizes of seals are tentatively classified into following six categories:

D-1: 8.5 - 11.0 mm

D-2: 12.5 - 16.0 mm

D-3: 16.5 - 28.5 mm

D-4: 28.5 - 35.5 mm

D-5: 38.0 - 40.0 mm

D-6: 41.0 / 41.5 mm

However, none of the motifs fit into all the 6 categories, and the majority of the seals are concentrated within D-3 and D-4. D-6 or the biggest category is restricted to the motif of horned deity-A in narrative scene (one example from Bhiranna, Rao et al. 2005: Plate. 10), and one of the other motifs (the house motif from Mohenjodaro). The smallest category of D-1 is also restricted to motifs of rhinoceros from Mohenjodaro (M-1140), scripts only from Banawali (B-19), Goat from Kalibangan (K-34) and wild ass from Kanmer (Kharakwar et al. 2012: Seal No-1). There are also motifs which do not have any categories larger than D-4, and these could be classified as separate sub groups.

Horned deity (deities) -A or C with either/and human figure (s), animal (s) and plant (s) (Figure 4.13b): Only seven examples from four sites of Mohenjodaro, Harappa, Bhirrana and Dholavira are known to have this motif, which are broadly

classified into D-3, D-4, D-5 and D-6. Rarity or uniqueness of this motif itself indicates distinct character, function and importance of its own, in contrast to the motifs such as unicorn which are found in abundance.

Tiger (Figure 4.5b): Total of 18 examples is found from six sites of Mohenjodaro, Harappa, Kalibangan, Chanhudaro, Dholavira and Lothal which are classified into D-3, D-4 and D-5. The majority is found from Mohenjodaro, and sole example of the largest D-5 category (39.0 mm) is found from Lothal (L-49).

Rhinoceros (Figure 4.6b): Total of 24 examples. The majority is found from Mohenjodaro and a few from Harappa, Kalibangan, Banawali, Allahdhino and Shortughai which are classified into D-1, D-3, D-4 and D-5. None is reported from Gujarat. The majority of the rhinoceros seals concentrate in categories D-3 and D-4 and only one examples each to D-1 (9.5 mm, M-1140) and D-5 (38.0 mm, M-1134) respectively from Mohenjodaro.

Human figure (s) and animal (s) (Figure 4.13a): Total of 15 examples is found from five sites of Mohenjodaro, Kalibangan, Banawali, Chanhudaro and Dholavira, which are classified into D-2, D-3 and D-4. None has been found from Harappa so far. The majority comprise of the seals from Mohenjodaro, including sole example of the small D-2 category (M-1183).

Composite animal (Figure 4.11a): Total of 14 examples is classified into D-3 and D-4. The composite animal motif is found from only three sites, the majority being those found from Mohenjodaro and one each from Harappa and Banawali.

Buffalo (Figure 4.8a): Total of fifteen buffalo seals is found from six sites. The majority is found from Mohenjodaro, along with a few each from Harappa, Kalibangan, Banawali, Farmana and Bhirrana, all of which are major sites of North-eastern regions. These are classified broadly into D-3 and D-4, in which the latter has only one example from Harappa (H-87).

Other motifs (Figure 4.12b): One each of total of five seals namely plant in a vessel,

offering stand (or staff), ship, house (or some kind of building), and unidentified motif (sometimes referred as harp) are grouped together as 'other motifs'. These are found only from Mohenjodaro, Harappa and Chanhudaro which are broadly classified into D-3 and D-6. As in case of motif of the horned deity-A or C in narrative scene, their rarity is noteworthy.

Animals with plant (a pipal tree sprouting from joined heads of two unicorns): Only one example is known from Mohenjodaro which corresponds with category D-5.

Gharial (Figure 4.9a): Only two examples are found from Mohenjodaro, which are tentatively classified into D-2 and D-4 categories respectively. In this case again, their rarity is noteworthy.

Animals in group: Only one example of half broken seal is found from Mohenjodaro. Two animals are visible on the remaining portion, which seems to be of unicorn and elephant. It may fall into either D-3 or D-4 category.

Horned deity-B (composite human figure with horns) (Figure 4.11b): Five seals of this motif are found from Mohenjodaro, Kalibangan and Nausharo which corresponds with category D-3.

Other bovine (urus) (Figure 4.8b): Seven seals of this motif are classified into D-2 and D-3 which are found from Mohenjodaro, Kalibangan, Banawali and Balakot. None is found from Gujarat. Three Large variety within D-3 is all from Mohenjodaro, whereas three smaller variety within D-2 belong to north-eastern sites of Kalibangan and Banawali.

Scripts only (Figure 4.15): Total of 21 seals with only scripts are classified into D-1, D-2 and D-3, without any larger categories. The majority is found from Mohenjodaro and the rest are from various sites throughout the Harappan territory - Harappa, Kalibangan, Banawali, Allahdino, Surkotada and Lothal. Sole example of a D-1 category seal measuring 9.5mm is found from Banawali (B-19).

Goat (Figure 4.7a): Total of 19 seals from five sites of Mohenjodaro, Kalibangan,

Banawali, Bhirrana and Lothal are classified into D-1, D-2 and D-3. The smallest size among entire Harappan seals is the goat motif measuring 8.5 mm found from Kalibangan (K-34).

Although there are some seals from Mohenjodaro and one from Lothal (the largest among this group), it is important to note that the majority is found from Banawali and Bhirrana or the sites in Haryana region. There are seals such as zebu, three headed animals, horned deity-A in narrative scene, rhinoceros, human figures and animal, composite animal, buffalo, other bovine, scripts only and geometric motifs that are found from these north-eastern sites. However, the goat seal is by far the most common variety seen in this group. This indicates regional variation, suggesting that owners of goat seals may have had their origin in these regions (Konasukawa 2011b). It may reflect chronological difference also (Konasukawa 2007).

I-E. Group E

Total of 145 seals with geometric motifs are included in this group. These seals are found from nine sites of Mohenjodaro, Harappa, Gumla, Kalibangan, Banawali, Bhirrana, Dholavira, Kuntasi and Lothal, maximum number of sites among all the motifs excluding unicorn. Round or square shapes of boss on back of the seals are also distinct. It is also noteworthy that these motifs are common with those depicted on seals of Pre-/Early Harappan phase (discussed in Chapter 3; Acharya 2008; Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991; Kenoyer 2001, 2009 ; Kenoyer and Meadow 2010; Konasukawa 2012, etc).

As stated earlier, geometric motifs can be classified into four sub-groups of (i) swastika, (ii) group of concentric circles, (iii) cross with concentric circles and (iv) others, but the latter three is combined in Figure 4.14b which are classified into two categories:

E-1: 11.0 - 21.5 mm

E-2: 28.0 - 34.0 mm

Pattern of size distribution of seals is very distinct of its own and there is a large gap in between E-1 and E-2. The majority also concentrates in E-1 category.

In case of swastika seal, almost all is found from Mohenjodaro and Harappa, and a few from Lothal (Figure 4.14a). They are highly concentrated in E-1 category and only five examples for E-2 or the larger category found from only Harappa and Lothal ⁽⁵⁾.

On the other hand, other geometric seals are found from a series of sites throughout the Harappan territory. E-2, however, consists of only two seals from Mohenjodaro and Harappa, both having similar motif of combination of cross and concentric circles (M-352 and H-638).

4-II. Regional Variation of the Harappan Seals

Based on distribution and concentration of sites, the Harappan Civilization can be broadly divided into following geographical regions: A: Sindh, B: Punjab, C: northern Rajasthan and Haryana, D: Kachi Plain and Balochistan, E: Gommal Plain, F: Gujarat, G: Makran and H: Afghanistan. One or a few large urban centers and a larger number of small settlements are situated in each region. Data is still limited about political system that maintained an order within the entire Harappan Civilization, but certain clues can be obtained from comparison of the seals. Common motifs discovered from various regions are obviously a result of common ideas, symbolic meaning and beliefs that were shared among all the people which acted as an important factor for uniting this civilization.

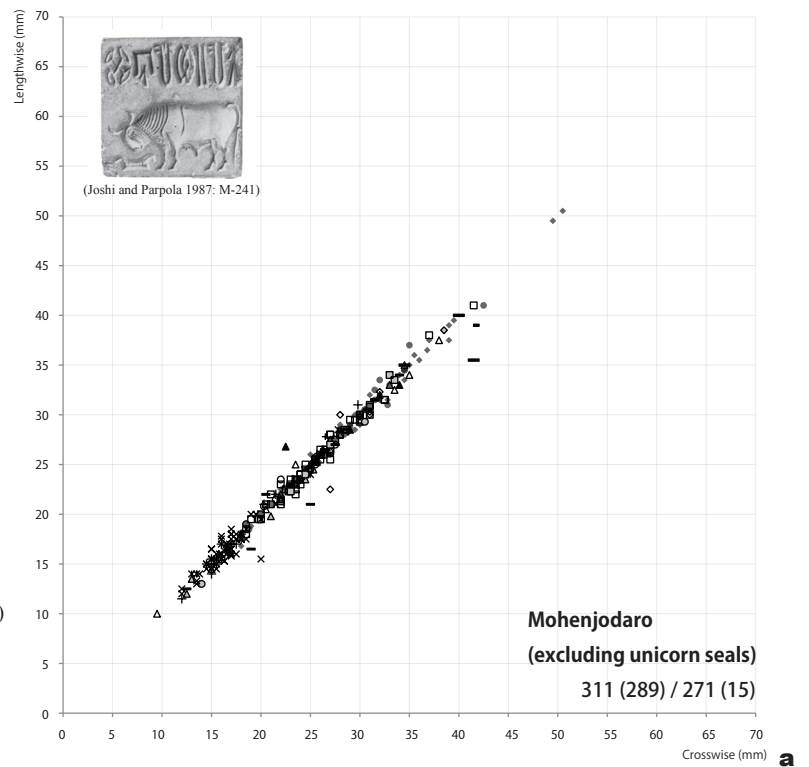
II-A. Sindh region

Many of the sites, dominated by Mohenjodaro, are located along and around River Indus flowing through region of Sindh. The total number of seals from Mohenjodaro alone is 65.9% or 1052 out of 1597 seals where their size could be measured (63.3% or 1127 out of the total of 1783 excavated seals) (Figures 4.9b and 4.17a). All variations of motifs are found from this site. As stated earlier, the majority

Legend (for Fig. 4.17a)

- Buffalo
- Gharial
- Elephant
- Bison
- Multi-headed animal
- ◇ Composite animal
- ◆ Animals with plant / Animals in group
- ◆ Zebu
- △ Rhinoceros
- ▲ Goat
- ▲ Tiger
- + Other bovine (urus)
- Other motifs
- Horned deity in narrative scene*
- Composite human figure (Horned deity)
- Human figure (s) and Animal (s)
- ✕ Scripts only
- ✕ Geometric (swastika)
- + Geometric (others)

*Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)



Legend (for Fig. 4.17b)

- Bison
- Multi-headed animal
- Unicorn
- ▲ Goat
- ▲ Tiger
- Other motifs
- Human figure (s) and Animal (s)
- ✕ Scripts only

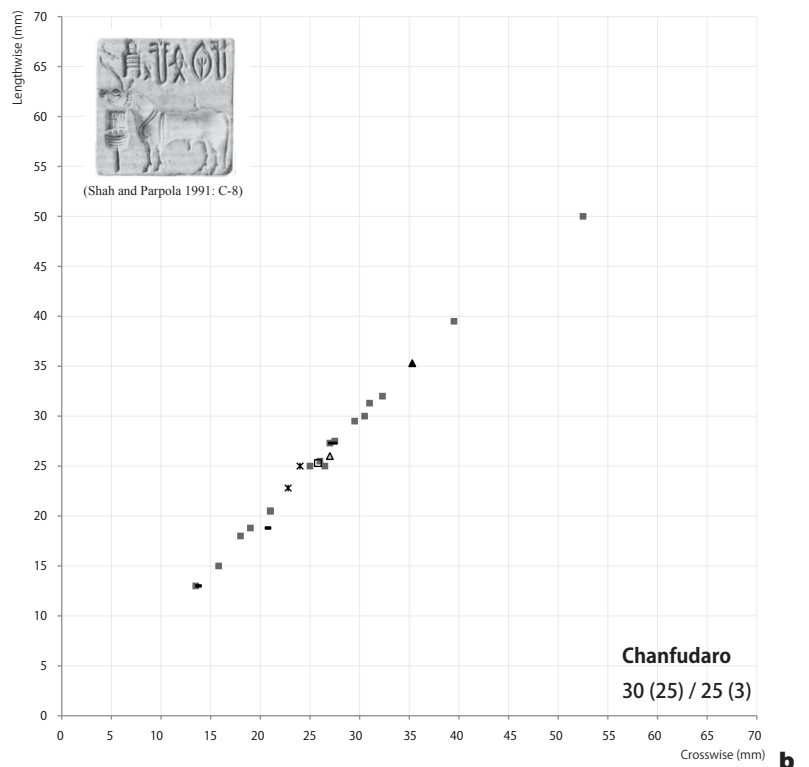
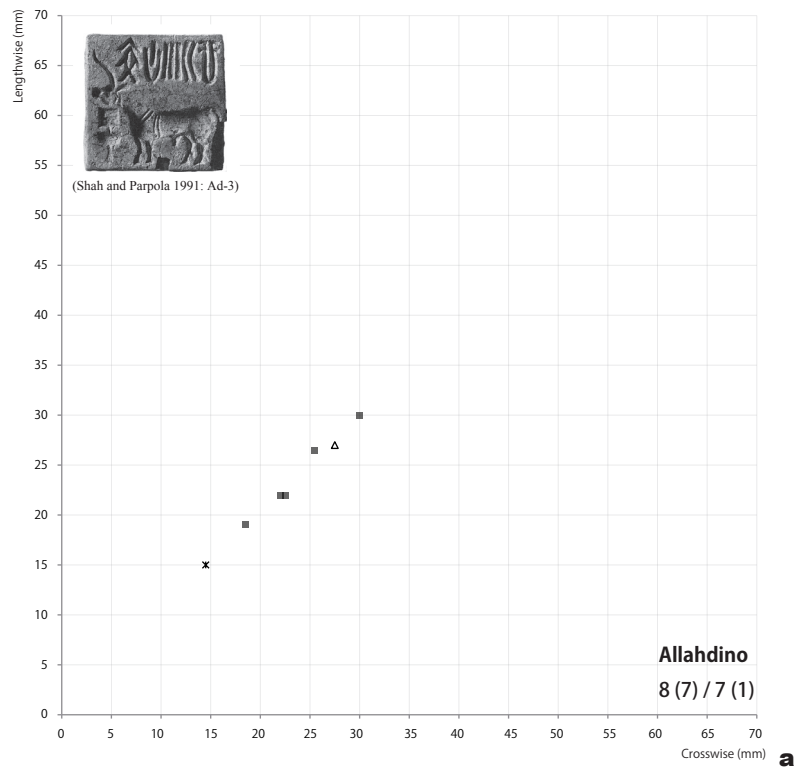


Figure 4.17a & 17b: Scatter plot of the measurement of Harappan seals (17a: Mohenjodaro, 17b: Chnafudaro)

Legend (for Fig. 4.18a)

- Multi-headed animal
- Unicorn
- △ Rhinoceros
- Other motifs
- ✕ Scripts only



Legend (for Fig. 4.18b)

- Unicorn
- + Other bovine (urus)

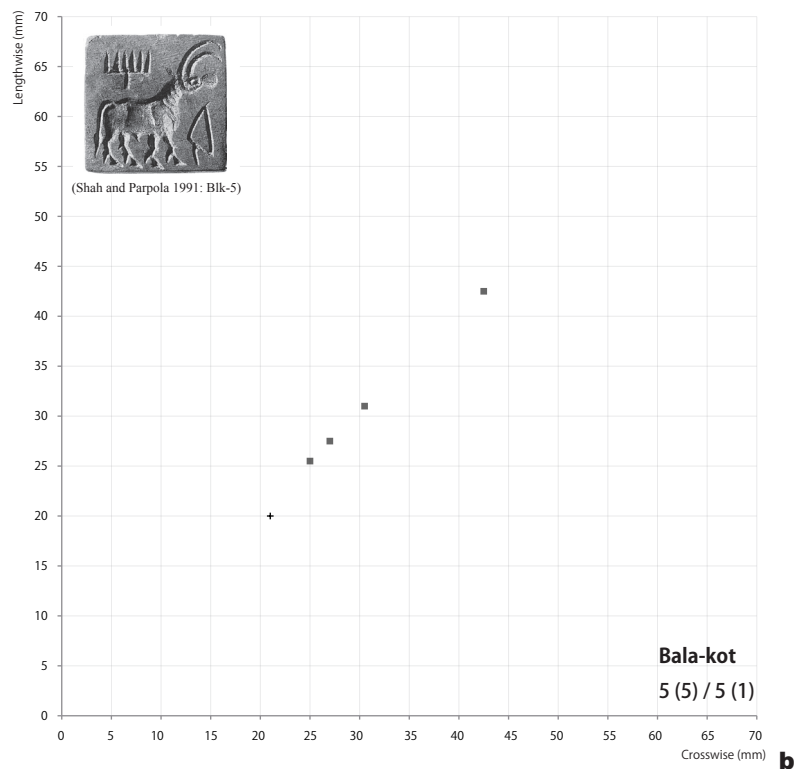
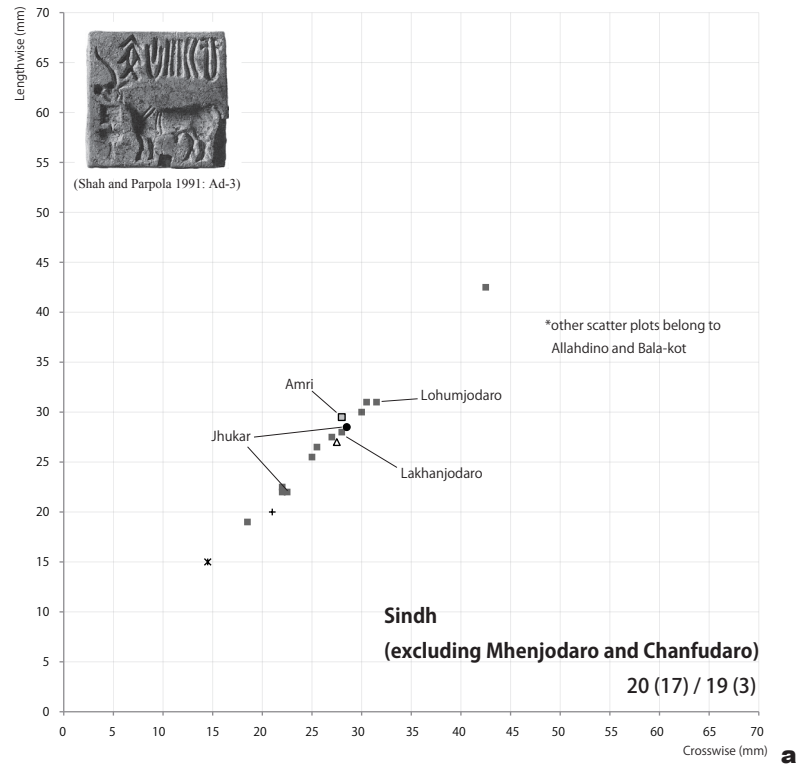


Figure 4.18a & 18b: Scatter plot of the measurement of Harappan seals (18a: Allahdino, 18b: Bala-kot)

Chapter 4

Legend (for Fig. 4.19a)

- Buffalo
- Gharial
- Elephant
- Multi-headed animal
- Unicorn
- △ Rhinoceros
- + Other bovine (urus)
- Other motifs
- ✕ Scripts only



Legend (for Fig. 4.19b)

- Buffalo
- Elephant
- Bison
- ◇ Composite animal
- ◆ Zebu
- △ Rhinoceros
- ▲ Tiger
- Other motifs
- Horned deity in narrative scene*
- ✕ Scripts only
- × Geometric (swastika)
- + Geometric (others)

*Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)

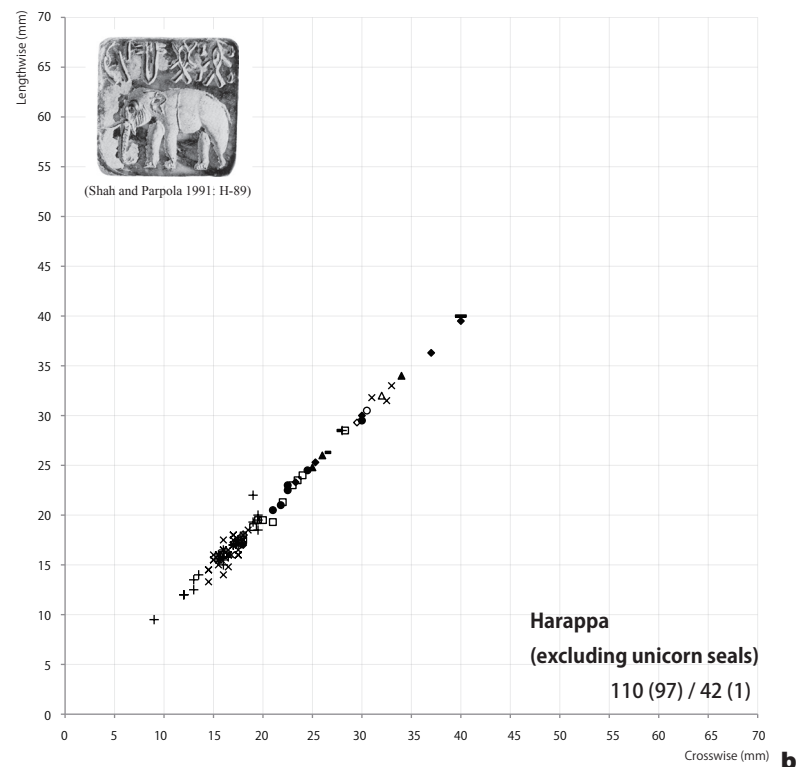


Figure 4.19a & 19b: Scatter plot of the measurement of Harappan seals (19a: Sindh, 19b: Harappa)

of seals with geometric motifs specifically, are restricted at the large urban sites.

In case of unicorn seals, Mohenjodaro alone constitutes 67.9% or 763 seals out of total of 1123 seals which their size could be measured (65.3% or 816 out of 1250 excavated seals). At the same time, Mohenjodaro is the only site which has all the size categories of the unicorn seals (A-1 to A-5).

Number of seals as well as variation of motifs from smaller sites is insignificant, except at Chanhudaro where various motifs such as unicorn, bison, goat, tiger, three headed animals etc. are found. Chanhudaro has comparatively large number of unicorn seals, and it is the only site besides Mohenjodaro that has one of the largest varieties of the unicorn seals (corresponding to A-4) (Figure 4.17b). Such features are a direct evidence of importance of this site, being one of the manufacturing cum trade centers of carnelian beads (Mackay 1943).

The unicorn seals of smaller size (A-1) are also found from a number of sites in Sindh, such as Chanhujo-daro, Jhukar, Lakhanjodaro, Lohumjodaro, Allahdino and Balakot, though unfound from Amri. (Figures 4.18 and 4.19a).

Other motifs such as zebu, bison, rhinoceros and elephants, composite animal seals are also found from various sites in Sindh.

II-B. Punjab region

Sites are located along the River Ravi and lower courses of River Ghaggar-Hakra in Punjab region of Pakistan where large sites such as Harappa and Ganweriwala etc. are located. Harappa has not been excavated extensively in comparison with Mohenjodaro and the total number of seals is less, though almost same variety of motifs is found. However, the motifs of goat and three headed animal are not found from Harappa which may indicate regional variation different from Sindh region. In case of unicorn seals, Harappa alone constitutes 21.8% or 245 seals out of total of 1123 seals which their size could be measured (24.4% or 305 out of 1250 excavated seals) (Figures 4.9b and 4.19b). Unicorn seals constitute 71.6% or 245 out of 342 seals excavated at Harappa which

their size could be measured (73.5% or 305 out of total of 415 excavated seals). A large number of seals with geometric motifs are also found.

II-C. Northern Rajasthan and Haryana

This is the region along the upper courses of River Ghaggar-Hakra and its tributaries located mostly in the present north Rajasthan and Haryana. Many seals are found in excavations at various urban sites such as Rakhi Garhi (Nath 1998, 1999), Kalibangan (Lal 1979, 1981; Lal and Thapar 1967; Thapar 1973), Banawali (Bishit 1993, 1999), Bhirrana (Rao et al 2004, 2005, 2006), Baror (Urmila Sant et al 2005) and Farmana (Shinde et al. 2011).

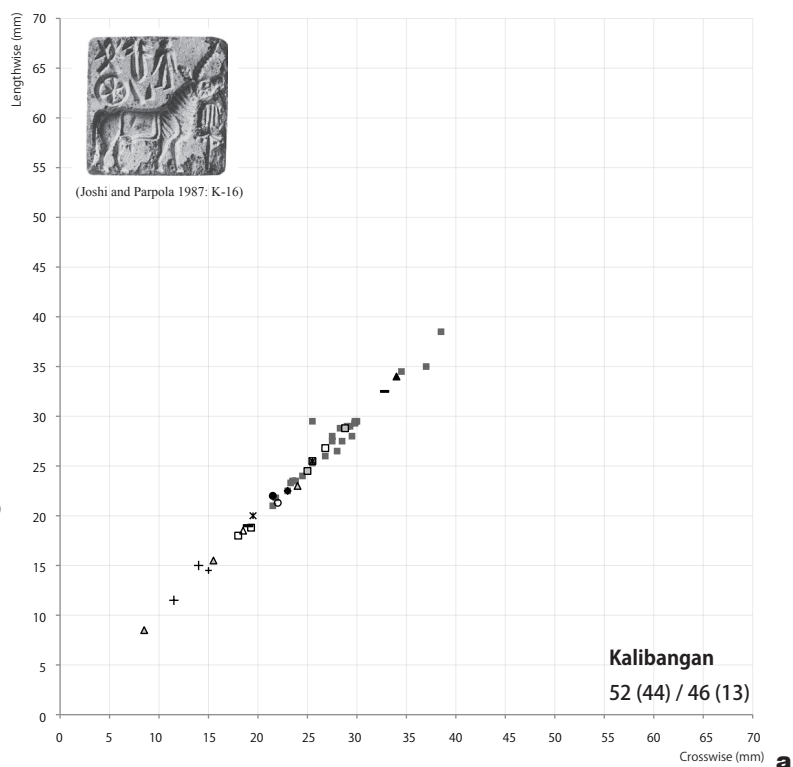
Both Kalibangan (Figure 4.20a) and Banawali (Figure 4.20b) have a large number of motifs of various animals as well as unicorn. All the urban sites in this region have unicorn seals. The seals having the animal motif or only scripts are also found commonly, though geometrical motifs are restricted in number with no examples of swastika motif (Figures 4.20 and 4.21a). However, no horned deity motif is found from Banawali.

On the other hand, there is a high concentration of goat seals at Kalibangan and Banawali and it is most likely that this region is the core region of the goat motif (Figure 4.7a). This region alone constitutes 57.9% or 11 seals out of total of 19 seals which their size could be measured (57.9% or 11 out of 19 excavated seals).

As far as direction of head of the animal motifs is concerned, it is worthwhile to note that many seals from Banawali, Bhirrana and Farmana depict animals with their head facing right (thus impressed image will face left), unlike the ones from other regions in which their head faces left (thus impressed image will face right). In this region, excluding Kalibangan, seals having a right-facing animal constitute 75% or 24 out of 32 seals which direction of head of main motif is clear (i.e. left or right). In Banawali, in particular, seals having a right-facing animal constitute 90% or 18 out of 20 seals which direction of head of main motif is clear (i.e. left or right). Such direction

Legend (for Fig. 4.20a)

- Buffalo
- Elephant
- Bison
- Multi-headed animal
- Unicorn
- ◆ Zebu
- △ Rhinoceros
- ▲ Goat
- ▲ Tiger
- + Other bovine (urus)
- Other motifs
- Composite human figure (Horned deity)
- Human figure (s) and Animal (s)
- ✕ Scripts only



Legend (for Fig. 4.20b)

- Buffalo
- Gharial
- Unicorn
- ◇ Composite animal
- △ Rhinoceros
- ▲ Goat
- + Other bovine (urus)
- Other motifs
- Human figure (s) and Animal (s)
- ✕ Scripts only
- + Geometric (others)

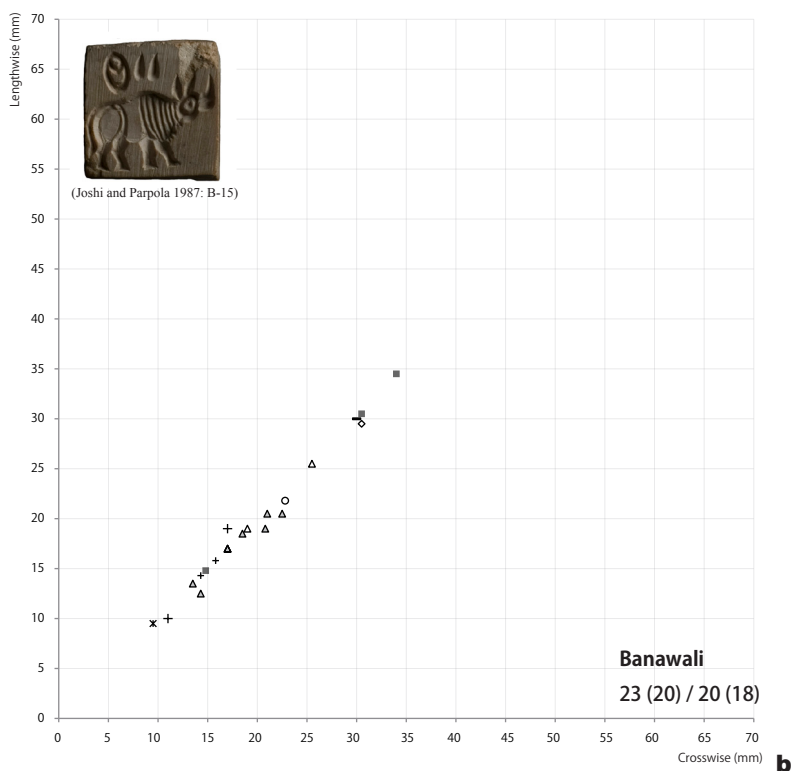
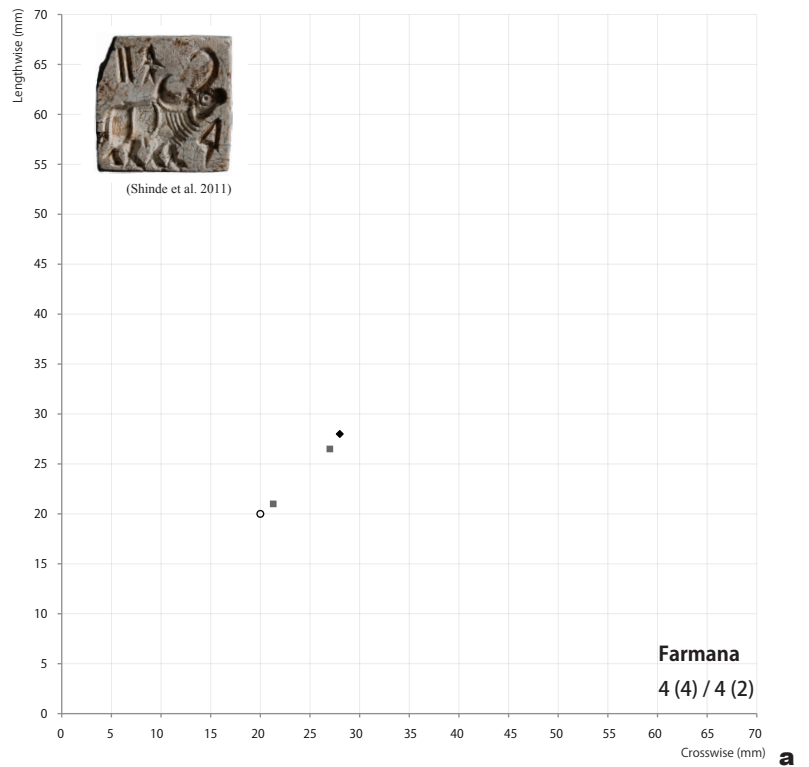


Figure 4.20a & 20b: Scatter plot of the measurement of Harappan seals (20a: Kalibangan, 20b: Banawali)

Legend (for Fig. 4.21a)

- Buffalo
- Unicorn
- ◆ Zebu



Legend (for Fig. 4.21b)

- Buffalo
- Multi-headed animal
- Unicorn
- ▲ Goat
- Horned deity in narrative scene*

**Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)*

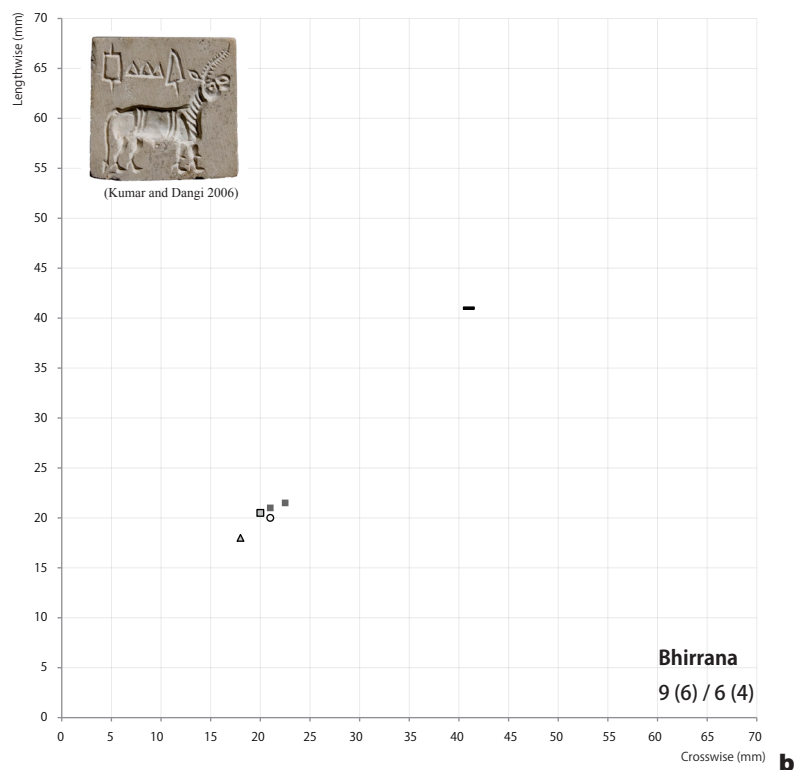
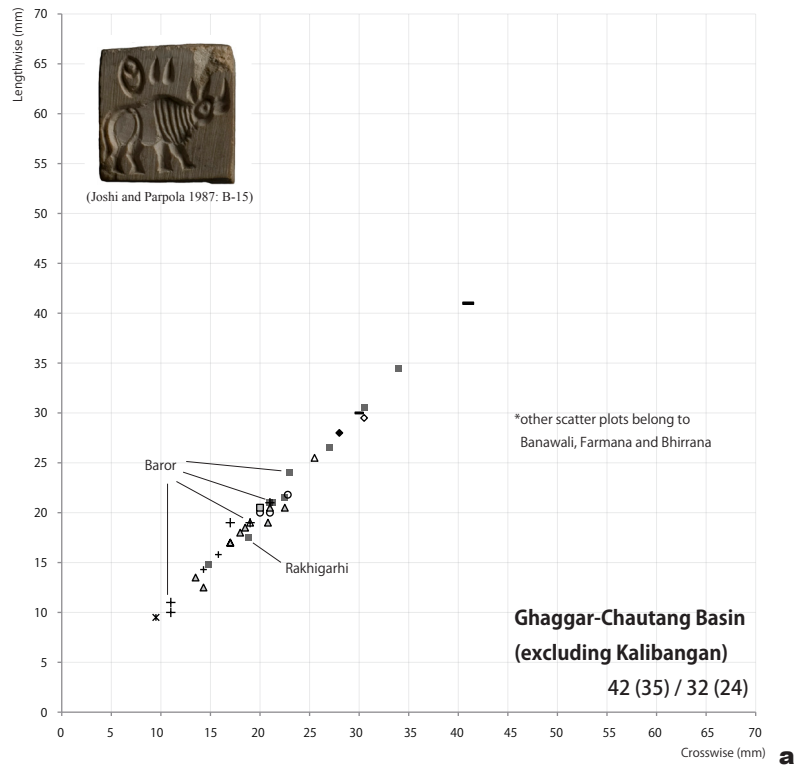


Figure 4.21a & 21b: Scatter plot of the measurement of Harappan seals (21a: Farmana, 21b: Bhirrana)

Legend (for Fig. 4.22a)

- Buffalo
 - Multi-headed animal
 - Unicorn
 - ◇ Composite animal
 - ◆ Zebu
 - △ Rhinoceros
 - ▲ Goat
 - + Other bovine (urus)
 - Other motifs
 - Horned deity in narrative scene*
 - Human figure (s) and Animal (s)
 - ✕ Scripts only
 - + Geometric (others)
- *Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)*



Legend (for Fig. 4.22b)

- Unicorn
- Composite human figure (Horned deity)
- ✕ Geometric (swastika)

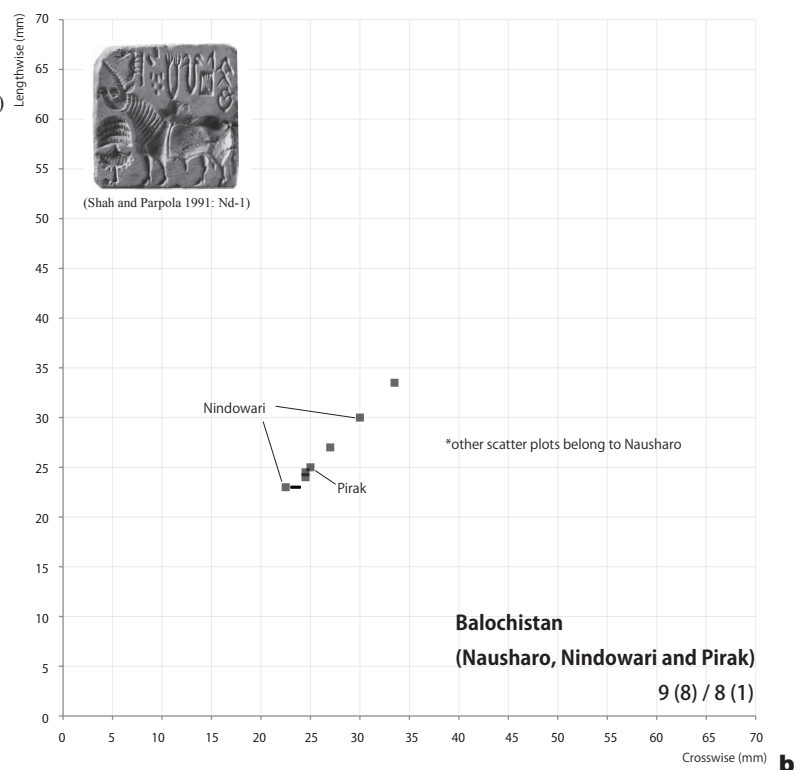


Figure 4.22a & 22b: Scatter plot of the measurement of Harappan seals (22a: Ghaggar-Chautang Basin, 22b: Balochistan)

of head most likely reflects regional variation (discussed in a full sense in the next Chapter).

II-D. Kachi Plain and Balochistan region

The Kachi Plain is located just below the Bolan Pass which connects the Indus Plain with Balochistan region and must have been a vital point for trade activities. This must be the reason why small sites of Nausharo and Pirak (surface finds) in Kachi Plain have unicorn as well as horned deity-C seals though total number of seals is only a few. Four unicorn seals are also found from Nindowari in southern part of Balochistan (Figure 4.22b).

II-E. Gujarat region

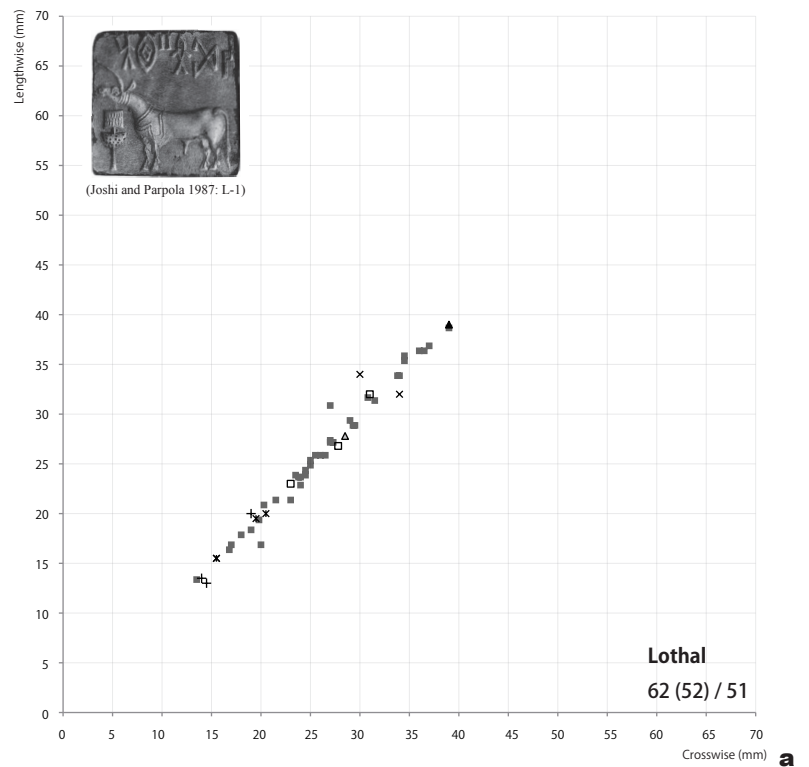
In this region, cities of middle to small size, such as Dholavira and Lothal are located. Dholavira, specifically, was excavated extensively by R.S. Bisht during 1990's and noteworthy of remarkably well preserved stone structures as well as many seals (Bisht 1991, 1999, 2004). Information is still limited, though seals with motifs of bison, tiger, unicorn, multi-headed animal, horned deity-A and geometric designs are found (NHK and NHK Promotion 2000; Joshi and Parpola 1987) (Figure 4.23b). It is also worth noting that the head of bison and multi-headed animal are depicted with their head facing right.

Lothal is also an important small city site known for its so-called 'dockyard' (Rao 1979). The number of unicorn seals from the site (B-1 and B-2 categories) follows that of Mohenjodaro and Harappa, 3.4% or 38 seals out of total of 1123 seals which their size could be measured (3.7% or 46 out of 1250 excavated seals). On the other hand, though the number is limited, variety of motifs such as bison, goat, tiger, geometrical and scripts only are also found, thus having various size categories (Figure 4.23a).

Lothal is also well known for its sealings (95 sealings) which are usually very limited in number even at huge cities of Mohenjodaro (19 sealings) and Harappa (3 sealings) (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991; Parpola

Legend (for Fig. 4.23a)

- Bison
- Unicorn
- ▲ Goat
- ▲ Tiger
- Other motifs
- ✱ Scripts only
- ✕ Geometric (swastika)
- + Geometric (others)



Legend (for Fig. 4.23b)

- Bison
- Multi-headed animal
- Unicorn
- ▲ Tiger
- Horned deity in narrative scene*
- Human figure (s) and Animal (s)
- ✱ Scripts only

*Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)

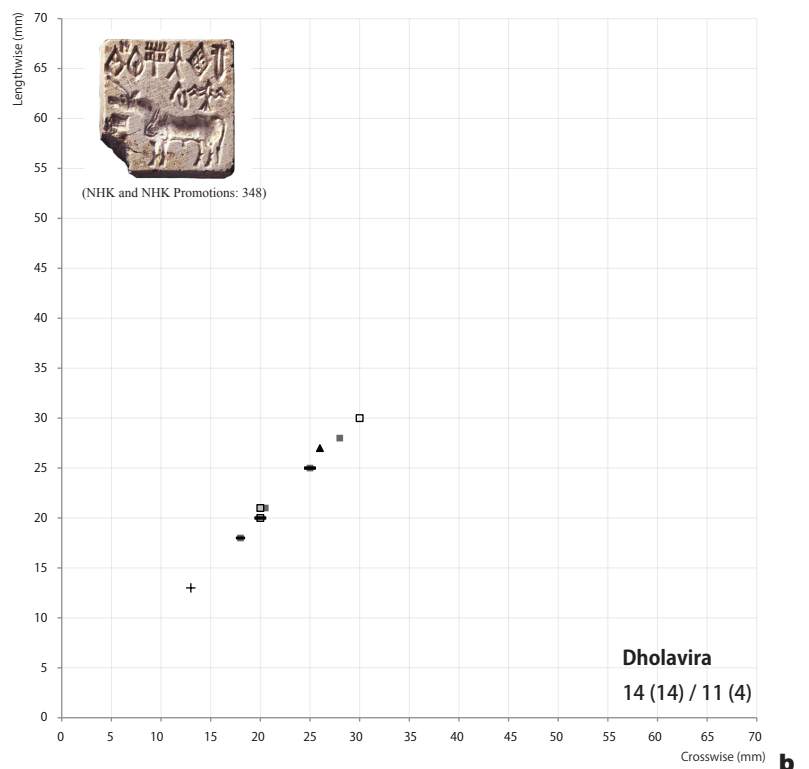
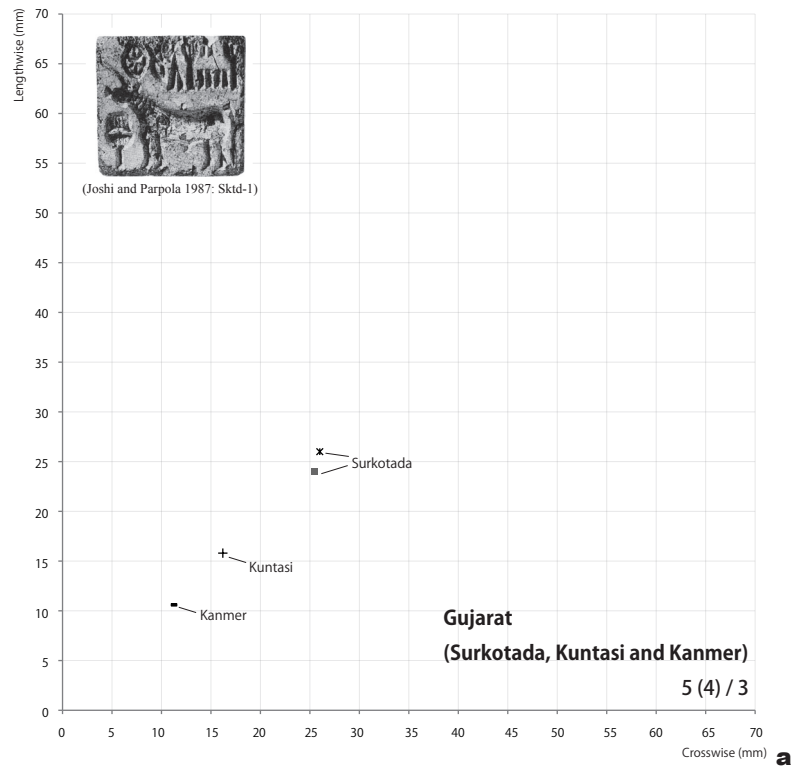


Figure 4.23a & 23b: Scatter plot of the measurement of Harappan seals (23a: Lothal, 23b: Dholavira)

Legend (for Fig. 4.24a)

- Unicorn
- Wild ass
- ✕ Scripts only
- + Geometric (others)



Legend (for Fig. 4.24b)

- Unicorn
- △ Rhinoceros
- ✕ Geometric (swastika)
- + Geometric (others)

**Horned deity (deities) with either/and human figure (s), animal (s), and plant (s)*

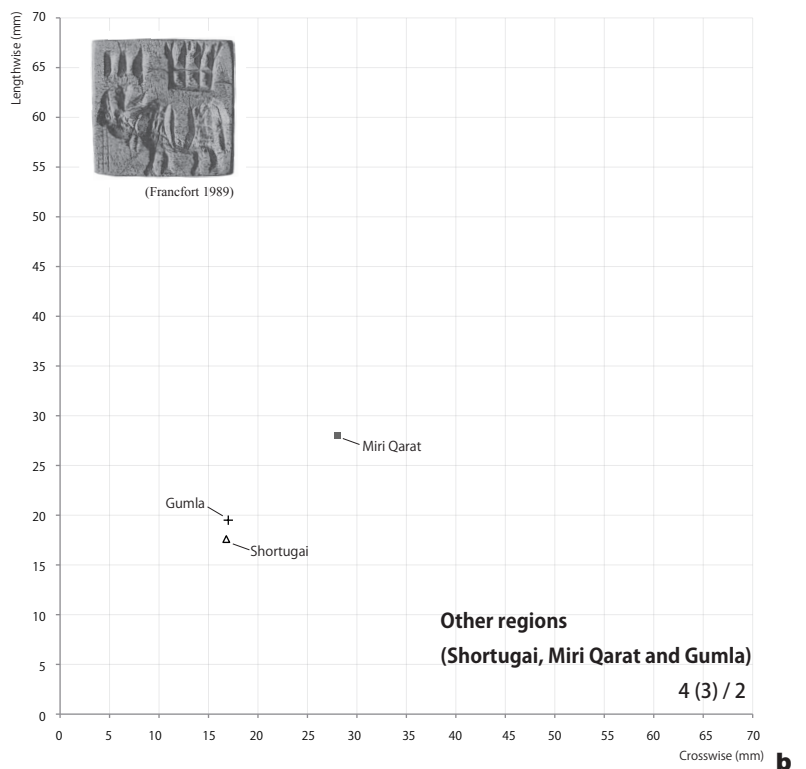


Figure 4.24a & 24b: Scatter plot of the measurement of Harappan seals (24a: Gujarat, 23b: Other regions)

1994b). As in case of Chanhudaro, agate and carnelian workshop is also found at Lothal, reflecting importance of this site as a trading post as well as manufacturing site.

Unlike Mohenjodaro and Harappa, only few geometrical motifs are found, but it is interesting to note that three swastika seals (both small and large categories) are found at Lothal. This is the only site that swastika seal is found after Mohenjodaro and Harappa.

Concerning other sites in Gujarat, one unicorn seal each is found from both Surkotada and Pabumath, and one geometric motif (concentric squares) is found from Kuntasi (Dhavalikar et al. 1996) (Figure 4.24a).

II-F. Gomal Plain

This is another locality that connects the Indus Plain with Balochistan, but no unicorn or horned deity seals are found here. One geometric seal from Gumla (G-11) and one bison seal from Maru II (exhibited in the Archaeology Museum of the University of Peshawar) is found (Figure 4.24b).

II-G. Makran

Makran is a peripheral region within the Indus territory but its direct relation with the core region of Sind is proved by single seals each of unicorn and swastika (Besenval and Marquis 1993) (Figure 4.24b). This region is regarded as a crucial point for Western trade, and there is a potential of finding more seals in the future.

II-H. Afghanistan

Shortugai is situated at a peripheral region within the Harappan territory but its direct relation with the core region because single seal having a rhinoceros motif is discovered (Francfort 1989: Planche XLI-2) (Figure 4.24b). This region is regarded as a crucial point for finding Lapis Lazuli, which is an important raw material of bead in the Harappan Civilization.

5. Discussion

The categorization or difference of size of seals most probably reflects official, commercial, economic, political or religious status of respective owners in the urbanized society. Owning and using seals must have been a privilege for traders or merchants who were approved by certain public authorities.

5-I. Bias

The fact that the unicorn seals alone constitute 70.1% of entire seals, and also that their majority is concentrated at Mohenjodaro and Harappa, is the most distinct feature of the Harappan seals. At the same time, unicorn seals are the only Harappan seal which is found from almost all the sites on the list where at least one seal is found, not confined only to the major urban sites but also found from minor urban sites and small settlements. In other words, wherever the site, perhaps priority of trade transactions were in the hands of owners of the unicorn seals.

On the other hand, Mohenjodaro and Harappa are the only sites where almost all the other motifs (and variations thereof), as well as all the size variations, are seen. There may have been division of labor among seal bearers and certain trading goods were handled by owners of certain seals only who all shared their role and responsibility of trade activities of the Indus society as a whole.

Chanhudaro is a unique exception among the small Harappan sites. Unlike other small sites, various kinds of motifs such as unicorn, bison, goat, tiger, multi-headed animal, plant in a vessel etc. are found from this site. However, no geometric seals are found. It is emphasized that the importance of Chanhudaro is also testified by presence of the large A-4 category of unicorn seal.

Concerning number of finds of seals and regions where either large or small urban sites are located, Sind and Punjab are definitely core regions, followed by northern Rajasthan and Haryana. The number of seals found from Gujarat is far less in comparison. As far as the number of seals found in the region is concerned, Gujarat

can be described as a region of less activity. But many sealings with impression(s) of Harappan seals have been discovered from Lothal.

5-II. Size categorization and hierarchy

It is clear from the above analysis that the Harappan type seals were made, though not so rigidly regulated, on certain size categorization of respective motifs. The majority of seals fall between around 17–35 mm and each group has at least two categories - large and small - which clearly indicate that there was a hierarchy among them. Even the geometric seals have large and small categories though their size distribution is unique. Larger seals are usually less in number, possibly owned by people in important authority positions.

Diversity of the motifs and their hierarchy obviously reflect the need of efficient control of trade within complex urban society and economy. This is in contrast with the Pre/Early Harappan phase where categorization or hierarchy of their geometric seals is unclear⁽⁶⁾.

Each motif must have been a symbol of a respective group of merchants sharing same roots, clan or totem who cooperated and jointly dealt with trade activities (Fairervis 1986; Kenoyer 2001; Vidale 2005). In the majority of cases, the same motif is shared among all the owners who belong to the same group. Only difference among them was ‘words’ depicted above the motif. These ‘words’ must have acted as ‘signatures’ in order to differentiate respective owners of seals bearing the same motifs.

II-A. Largest seals

The largest seals exceeding 45 mm are confined to the unicorn and zebu seals found from two large urban sites of Mohenjodaro and Harappa (with one exception from Chanhudaro). This suggests that their owners were high ranking merchants, not only among the unicorn and zebu seal owners but among the entire group of Harappan seal owners. The extremely fine and delicate workmanship of engraving of these seals also support this view. A. Parpola has also suggested that common ‘words’ depicted

above the unicorn motif of very large variety may reflect such hierarchy (Parpola 1986).

The largest categories of each motif are found in Mohenjodaro in most of the cases, except motifs of horned deity-A in narrative scene (Bhirrana), tiger (Lothal), buffalo (Harappa), goat and geometric-swastika (Harappa and Lothal), which indicate the magnitude of this site. This suggests that the owners of the largest seals usually stayed at either Mohenjodaro or Harappa and the owners of smaller seals were posted at both the largest as well as smaller sites in various regions of the Indus territory. Thus, the importance of the seals directly reflects the importance or hierarchy of sites as well.

II-B. Rare motifs

However, in some cases (motifs with horned deity-A, B, C, gharial, animals with plant, animals in group and those classified as other motifs), respective motif occurs only once or very rarely. The majority of the horned deity-A, B and C motifs are restricted to the major city sites of large to middle size, namely, Mohenjodaro, Harappa, Kalibangan, Banawali, Bhirrana and etc. All these seals belong to group D in the present analysis, though size hierarchy does not exactly apply to them. Many of them are found from Mohenjodaro and some examples from other urban centers such as Harappa, Kalibangan and Dholavira, but not from small sites. The owners of these seals also stayed at these cities and controlled trade transactions.

Such motifs had certain specific meaning different from those seals found in abundance like the unicorn seals. In case of the unicorn seals for example, the motif itself strongly indicates the group to which the owner belongs, but in case of rare motifs like that of horned deity-A, B, C or gharial, the motifs indicate the individual owners themselves. In other words, the owners who could use these seals could have been engaged in specific positions in major cities.

For example, such functions are indicated from the very fine and delicate workmanship of the seals from Mohenjodaro with horned deity-A, B and C appearing in the motifs. However, the horned deity-A seal from Dholavira is so roughly made that

it could almost be called fake. Such distortion is not as bad in case of unicorn or other motifs. This may reflect reality or difficulty of integrating the civilization which has expanded into vast geographical regions.

The individuality of the seals has some similarity with the Mesopotamian cylinder seals where the motif on each seal is different, though some divine figures or animals do appear repeatedly. Furthermore, the hoards of sealings that are common in Mesopotamian are not found in case of the Indus sites. This may reflect a difference of attitudes towards preserving records of trade activity in the two civilizations.

5-III. Direction of an animal's head depicted on the seals

The most distinct feature of many of the Harappan seals from Haryana region is direction of head of animal which is engraved facing right (thus faces left on impressed image). As stated earlier, in this region, seals having a right-facing animal constitute 75% or 24 out of 32 seals in which the direction of the head of main motif is clear (i.e. left or right). Among them, goat seals (concentrate in D-1 and D-2 categories) are the most prominent. Seals having a right-facing goat constitute 65% or 13 out of 20 seals which direction of head of main motif is clear (i.e. left or right). The shape of the boss on the reverse side also differs from other regions, which is small, slim and square or cylindrical (Konasukawa 2011b). This suggests that the owners of goat seals had a different origin from other seal owners. Chapter 5 will deal with this issue in greater detail.

6. Chapter conclusion

This chapter looked at the size of Harappan seals and their significance. For the analysis, these square type seals are first classified based on the motifs, and secondly by size measurements (lengthwise and crosswise). The size measurements are simply taken by measuring photographs of each seal published in three volumes of *the CISI* and so on.

Scatter plot graphs were made based on the measurements of the size of seals, and then a graph of motifs and their size distribution was made in order to showcase the size categorization of Harappan seals.

As a conclusion to this chapter, based on the size categorization, Harappan seals can be classified into groups A to F. A-5 and A-4 in group A (unicorn) are placed at the highest rank in the size categorization of Harappan seals.

The size categorization of Harappan seals, which is based on motifs and their size distribution, was needed and created to control the complicated socio-economic structure (i.e. trade) of Harappan Civilization. For this reason, it can be pointed out that the size categorization of Harappan seals is one of the important strategies to show commercial or religious hierarchies among the owners who engaged in socio-economical activities in this Civilization.

Notes

- 1) Seal types (ii) and (iii) will be discussed in another study, because the number of seal type (ii) is a few and (iii) has only script(s) as a main motif.
- 2) Typological changes of Harappan seals are still not understood. I examined typological changes of Harappan seals based on the comparing study with the seals discovered from outside of the Greater Indus region (Konasukawa 2007). But I have to wait for increasing of seals having a good context and then examine them in a full sense for better understanding of typological changes of Harappan seals.
- 3) The next volumes of *CISI* comprises of the seals etc. which are excavated recently and stored in the museums etc. situated at the outside of India and Pakistan. I have to examine those seals etc. for the further comprehensive analysis after its publication.
- 4) The percentage of motifs which is accompanied with a staff or a manger is mentioned here respectively. The total number for computing this percentage consists of the seals having an accurate motif (see Tables 4.1 to 4.3), excluding broken pieces without the specific part of the surface where a staff or a manger could be placed. Concerning the broken pieces, based on the percentage mentioned as follows, it is very likely that they had a staff or a manger at the broken part originally. 98.4% (1084/1102) of Unicorn seal and 37.5% (3/8) of Other bovine (urus) seal have a staff in front of the main motif. 97.5% (77/79) of Bison seal, 63.6% (7/11) of Buffalo seal, 62.5% (10/16) of Rhinoceros seal and 90.9% (10/11) of Tiger seal have a manger in front of the main motif. All exceptions which do not have a staff or a manger in those motifs are shown in Appendix 4.1. Concerning the other exceptions, one example (M-1152) in Elephant seals has a manger, one example (L-48) in Goat seals has a manger, one example (B-17) in Horned tiger seal has a staff and two examples (M-1135 and K-39) in Rhinoceros seals have a staff (Appendix 4.2). According to their percentage, it is very likely that they have a staff or a manger only in exceptional cases.
- 5) A very large Harappan seal having a swastika motif (102mm as crosswise by 100mm as lengthwise) is reported from Lothal (L-69). But the size of this seal cannot be compared with other seals because of its unnatural size. So, this seal is omitted from the present analysis.
- 6) Total number of the seals of Pre-/Early Harappan period is few in comparison with Harappan seal (see Chapter 3). Based on the total number and motif which is restricted in geometrical examples, it could be said that size categorization was not needed in the seals of Pre-/Early Harappan period.

Chapter 5

Design of the Harappan Seals

: Consideration of the Harappan Seals Having a Right-facing Animal Motif

Chapter 5 - Design of the Harappan Seals : Consideration of the Harappan Seals Having a Right-facing Animal Motif

Chapter introduction

Chapter 5 will discuss the Harappan seals in terms of aspects such as motifs, Harappan scripts, arrangement pattern of motifs, type of boss, size and distribution pattern with a view to understand the design of the Harappan seals and the significance of the Harappan seals having a right-facing animal motif.

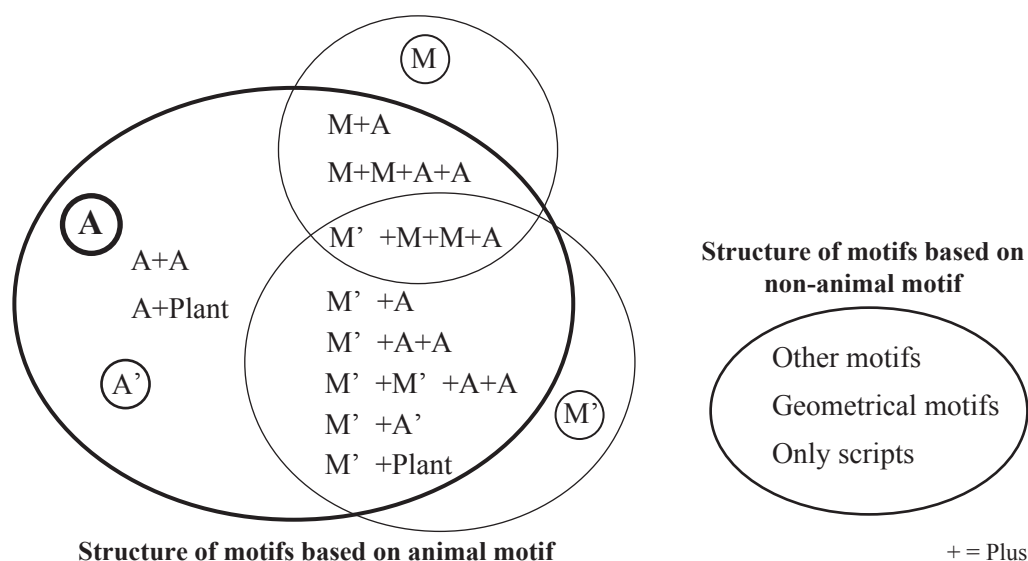
1. Background and aims

The synthetic study of various aspects of Harappan seals has not been accomplished and each aspect of the seals was discussed individually in the majority of cases (see Chapter 2). Based on the enough accumulation of data in recent situations, it is very important to appraise all the aspects of Harappan seals for better understanding their structure.

This chapter focuses on the design of the Harappan seal, which comprises motifs depicted on the surface, size, arrangement pattern of motifs, shape and their distribution pattern, to aim at a synthetic interpretation of the Harappan seals, especially the significance of the Harappan seals having a right-facing animal motif.

2. Basic data for analysis

Basic data for the analysis of this Chapter is same to that discussed in Chapter 4 (see Tables. 4.1 to 4.3).



A: Real animal A+A: Real animals A' : Imaginary animal M: Human figure M+M: Human figures
M' : Composite fuman figure (Horned deity) M' +M' : Composite fuman figures (Horned deities)

Figure 5.1: Conceptual diagram about the structure of Harappan seal's motifs

3. Design of the Harappan seals

Some specific features of the Harappan seals are discussed here, such as motifs depicted on the surface, size of the seals, arrangement pattern of motifs, shape and their distribution pattern, to understand the specific rules of design of the Harappan seals ⁽¹⁾.

3-I. Motifs depicted on the surface

The main motifs depicted on the surface of the seals are wide-ranging (Tables 4.1 to 4.3). The concrete single animal motifs form the majority of all of motifs and they are divided into two types, namely real animal (i.e. zebu, buffalo and bison, etc.) and imaginary animal (i.e. unicorn, horned-tiger and triple headed animal, etc.). In case of human figure also, the motifs are divided into two types, namely human figure and imaginary one such as human figure with horns, referred to as 'horned deity'. In this study, motifs constituted of single human figure are classified as composite human figure (subdivided into Horned deity-A and Horned deity-B), and motifs consisting of human figure (s) and others are classified as Human figure (s) and animal (s) and

Horned deity (deities) -A or C with either/and human figure (s), animal (s) and plant (s). Furthermore, there are motifs of swastika, cross, group of concentric circles, house and ship, etc. as other motif. The details of each motif are already discussed in detail earlier in Chapter 4.

A conceptual diagram (Figure 5.1) shows the structure of motifs depicted on the seals. This diagram shows that the structure of motifs is based on animal motifs and non-animal motifs, especially animal motif. In connection with this point imaginary animals and human figures also based on animal motif because part of them are derived from animals. 90.1% or 1592 out of total of 1766 (excluding other unidentified motifs) are based on animal motif. As described by this observation, the structure of motifs depicted on the seals is based on animal motif.

The general feature of these motifs is that the total number of each motif is different from that of other motifs. 70.1% or 1250 out of total of 1783 seals are occupied by only unicorn. On the other hand, other motifs occupy only 0.05 to 5.4% of total of the seals and the majority being below 1%. Quite a number of motifs have only a few, or even only one excavated example. The motifs, which occupy the large number, are as follows; swastika (5.6% or 96 out of total of 1783 seals), bison (4.8% or 86 out of total of 1783 seals), zebu (3.1 % or 55 out of total of 1783 seals) and elephant (2.5% or 44 out of total of 1783 seals) (see Tables 4.1 to 4.3).

3-II. Harappan scripts

Harappan scripts, which are engraved along with a main motif, usually on the upper part of the surface, are also an important feature of the Harappan seals. The total number of Harappan scripts amount to around 400 letters. They have been studied by the teams from Finland (Parpola 1994), the erstwhile Soviet Union (Zide and Zvelebil 1976) and others (Mahadevan 1977; Possehl 1996; Rao 1982) since 1960's. Their studies conclude that Harappan scripts have something in common with the Dravidian language in the living language. However, the Harappan script has not been deciphered

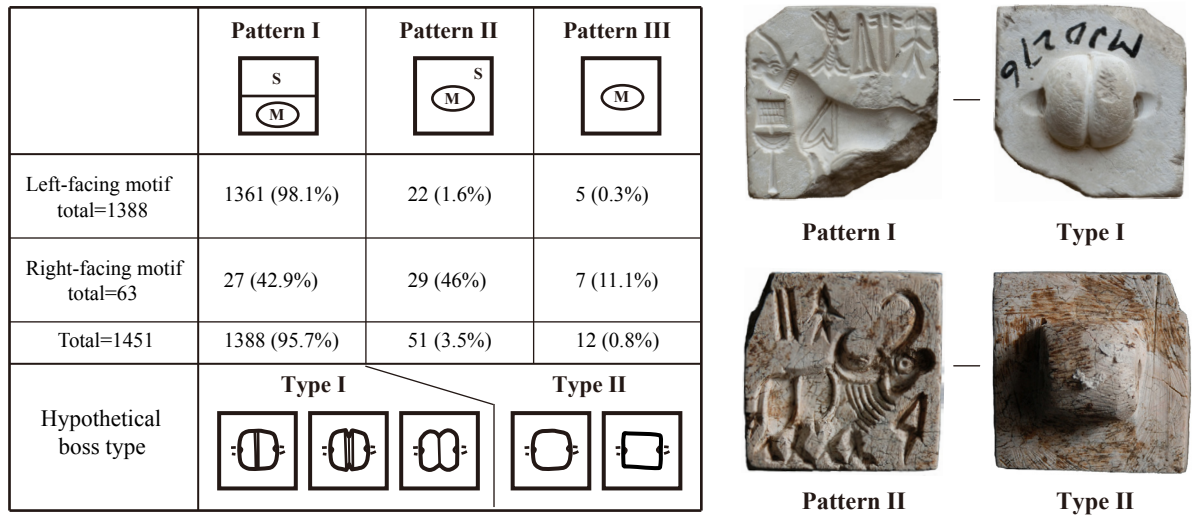


Figure 5.2: Motif arrangement patterns and hypothetical boss types

because there are no long sentences composed in the Harappan script, or any artifact with a bilingual inscription such as the Rosetta Stone.

Although Harappan scripts have been animatedly discussed by various scholars even recently, (Farmer, et al 2004, etc.), it can be pointed out here that Harappan scripts have not been deciphered and there is a specific trend of the arrangement pattern of Harappan scripts and motifs. As is indicated by A. Parpola's analysis, the large-size seals in Parpola's classification share some common Harappan scripts with each other (Parpola 1986). Furthermore, it is assumed that there is a basic rule for reading the scripts, namely reading from left to right direction. And it can be said that Harappan scripts can be read properly only when they are impressed on an object because of their stamp-like shape and the existence of sealings.

3-III. Arrangement pattern of the motifs

The arrangement pattern of the motifs on the Harappan seals shows a specific rule of arrangement, consisting of a main motif and Harappan script, that are engraved on the surface of the seals. The arrangement patterns of the motifs are classified into three patterns as follows (Figure 5.2),

Table 5.1: The number of arrangement patterns of each motif

			Arrangement pattern of motifs		
			Pattern I	Pattern II	Pattern III
Single Motifs	Real Animals	Bison	81	-	1 (1)
		Zebu	50 (1)	1	-
		Elephant	36 (1)	-	-
		Rhinoceros	22 (4)	1	-
		Goat	2 (2)	15 (9)	1 (1)
		Tiger	17	-	-
		Buffalo	10 (2)	2 (2)	1 (1)
		Other bovines ('urus')	5 (1)	3 (3)	-
		Gharial	2	-	-
		Wild ass	1	-	-
	Imaginary Animals and Deity	Unicorn	1133 (13)	12 (7)	-
		Composite animal	16 (1)	2	-
		Composite fuman figure ('horned deity')	4 (2)	1	-
		Three headed animal (joined animal)	1	6 (5)	3 (2)
	Other motifs	Other unidentified motifs	2	-	-
Group Motifs	Real motifs	Human figure (s) and animal (s)	5	5 (3)	3 (2)
	Imaginary motifs	Horned deity (deities) with either/and human figure (s), animal (s) and plant (s)	3	2	3
		Animals with plant	-	1	-
Total			1388 (27)	51 (29)	12 (7)
			1451 (63)		

*Each number is of the seal(s) having an accurate arrangement pattern of the motifs (namely Patterns I, II or III)

*Numbers in parentheses are the Harappan seals having a right-facing animal

Pattern I: a main motif is engraved in the lower part along with Harappan scripts (described as 'S' in Figure 5.2) which are depicted in the upper part of the surface,

Pattern II: a main motif is engraved in the centre part and Harappan scripts are depicted in a space of the surface, not restricted to the upper part of the surface,

Pattern III: only a main motif is engraved without any Harappan scripts.

81.4% or 1451 out of total of 1783 seals indicate accurate motif arrangement pattern (i.e. Patterns I, II and III). Pattern I occupies 95.7% or 1388 out of total of 1451 seals, Pattern II occupies 3.5% or 51 out of total of 1451 seals and Pattern III occupies 0.8% or 12 out of total of 1451 seals (Table 5.1). As is indicated by this analysis, it is emphasized that the basic design of the surface is based on Pattern I.

It is worthwhile to note that 98.1% seals characterized by Pattern I have a left-

facing animal as a main motif (Figure 5.2 and Table 5.1). On the other hand, with regard to the seals having a right-facing animal, only 42.9% seals are characterized by Pattern I and the rest are characterized by Patterns II (46%) and III (11.1%) respectively (Figure 5.2 and Table 5.1).

As far as the arrangement patterns of each motif are concerned, though the majority of motifs are arranged by Pattern I, goat and three headed animal (joined animal) motifs are based on Pattern II, 83.3% or 15 out of total of 18 seals and 60.0% or 6 out of total of 10 seals respectively (Table 5.1). Both motifs are basically characterized by a right-facing animal, not a left-facing one.

Furthermore, some cases of the seals characterized by a main motif having no accurate direction of head (i.e. the motifs related with composite human figure (s) and other motifs, etc.) are expressed in Pattern III. In connection with this point, it can be noted here that these motif types shared specific information without Harappan scripts.

3-IV. Type of boss

The boss on the back of the Harappan seal is also an important feature in understanding their design. Although there are only a few lateral photographs showing a boss of seal in even *the CISI* (Joshi and Parpola 1987; Parpola et al. 2010; Shah and Parpola 1991), the bosses of the Harappan seals can be broadly divided into two types as follows (Figure 5.2) ⁽²⁾,

Type I: a boss as a typical example is shaped in symmetry by an incised center line on the square- or bullnose square-shaped boss,

Type II: a boss has a simple shape in comparison with Type I and has a just square- or bullnose square-shaped boss without an incised center line.

As is described by the present observation, it should be confirmed here that Type I basically forms a specific set with Pattern I of arrangement pattern of the motifs. Furthermore, the combination of ‘Pattern I plus Type I’ makes up a specific set with a left-facing animal motif (Figure 5.2).

3-V. Size of the seals

Size of the Harappan seals is already discussed in Chapter 4. As is described by the analysis, each motif and site has different size categories (i.e. categories A, B, C, D and E). For example, the large-size category, more than 50.0mm, is restricted to unicorn excluding one example of zebu. In addition, sites having all size categories including large-size category are restricted to three sites, viz. Mohenjodaro, Harappa and Chanhudaro. Mohenjodaro and Harappa are the two largest urbanized centres and Chanhudaro is an important manufacturing site of special artifacts such as carnelian beads etc.

Based on this analysis, it can be pointed out that the manufacture process of the Harappan seals was controlled by the size-category system. As mentioned in previous chapter, the size categorization is based on a system characterized by the seals having a unicorn motif, which can be placed at the highest rank in all of motifs because of the quantities and the size (i.e. A-4 and A-5), and specific distribution patterns. It is worth mentioning here that their features reflect the existence of the socio-economic hierarchy in the urbanized society of Harappan Civilization.

3-IV. Distribution pattern

As mentioned above, 86.5% or 1542 out of total of 1783 seals is concentrated in two major urban centres, Mohenjodaro and Harappa. As far as other regions are concerned, 5.3% or 94 out of total of 1783 seals is discovered in the Ghaggar basin, 4.6% or 81 out of total of 1783 seals is discovered in the Gujarat and 0.75% or 14 out of total of 1783 seals is discovered in the other regions (i.e. 0.5% or 9 out of total of 1783 seals from the Balochistan, 0.1% or 2 out of total of 1783 seals from the Gomal, 0.1% or 2 out of total of 1783 seals from the Makran and 0.05% or 1 out of total of 1783 seals from the Afghanistan). According to this situation, the Harappan seals were likely used mainly within the urban centres, and we can understand that some specific regions in which lots of seals are discovered, such as Sindh, western Punjab, Ghaggar and Gujarat

regions, as main distribution areas of the seals. Furthermore, a few seals are discovered from the outside of the Greater Indus region such as Mesopotamia, the Arabian Gulf and southern Turkmenistan (Brunswick, Parpola and Potts 1983; Gadd 1932; Masson 1988; Mitchell 1986; Sarianidi 2006, etc.)⁽³⁾.

Concerning excavated situation of the seals, No 'hoard' of the Harappan seals has been discovered so far. Seals are basically discovered along with many potsherds and other terracotta artifacts from the deposit layer of the settlement.

As far as the distribution pattern of the sealings of Harappan seal is concerned, the total number amounts to 135 sealings and a 'hoard' of sealings has not been also reported so far.

According to photographs in *the CISI*, I counted only the sealings which have impression (s) originating from Type (i) seal. The total number of the sealings is fewer in comparison with the number of the seals themselves. The number of the sealing excavated from each site is as follows. The descriptions about 'the direction of a main animal motif' in the following part refer to the direction in the impression, so the direction on the original seal itself is reversed.

8 sealings from Mohenjodaro (8 unicorn: face to the right with Pattern I, 1 zebu: faces to the right with Pattern I, 1 elephant: faces to the right with Pattern I, 4 animals, 1 narrative scene, 2 geometric motif, 2 unknown motif: one of two faces to the right with Pattern I), 3 sealings from Harappa (1 unicorn: faces to the right with Pattern I, 1 composite animal: faces to the right with arrangement pattern is unknown, 1 unknown motif), 95 sealings from Lothal (44 unicorn: face right direction with Pattern I, 11 elephant: face to the right with Pattern I excluding one unclear example and 10 examples can be originated in a same seal, 1 three headed animal: faces to the right with Pattern I, 3 geometric motif, 13 scripts only, 23 unknown motif), 11 sealings from Kalibangan (6 unicorn: five to the face to the right with Pattern I and one faces to the left with Pattern I, 1 zebu: faces to the right with arrangement pattern is unknown, 1 goat:

faces to the left with Pattern II, 1 composite animal: faces to the left with Pattern I, 2 unknown motif), 1 sealing from Banawali (1 narrative scene), 1 sealing from Rakhigarhi (1 unicorn: faces to the right with Pattern I), 3 sealings from farmana (2 unicorn: face to the left with Pattern II, 1 unknown animals: face right direction with arrangement pattern is unknown), 2 sealings from Rohira (2 narrative scene). As confirmed here, a specific situation, namely the number of sealings being more than the seal itself, is recognized in Lothal (62 seals/95 sealings), where is understood as a port city in Harappan Civilization. Likewise, another situation (52 seals/11 sealings) is confirmed in Kalibangan. These situations are so different in comparing with Mohenjodaro (1127 seals/8 sealings) and Harappa (415 seals/3 sealings). It can be pointed out here that the different distributional pattern of the sealing confirmed here shows the difference of the function of each site on the trade activity etc. in this Civilization ⁽⁴⁾.

4. Design of the Harappan seal having a right-facing animal motif

In this part, some aspects of the Harappan seals having a right-facing animal are confirmed in a full sense to understand their significance.

4-I. Motifs engraved on the surface

There are 74 Harappan seals having a right-facing animal (Tables 5.1 to 5.3). As far as the percentage of each motif is concerned, 65% or 13 out of total of 20 seals having a goat motif, 63.6% or 7 out of total of 11 seals having a three headed animal motif, 37.5% or 6 out of total of 16 seals having a buffalo motif and 50% or 4 out of total of 8 seals having a urus motif are characterized by a right-facing head.

Among the motifs composed of figure or animal (s) that show accurate head direction, 66.7% or 2 out of total of 3 seals having a composite human figure (subdivide into Horned deity-A and Horned deity-B) motif and 85.7% or 6 out of total of 7 seals having Human figure (s) and animal (s) motif are characterized by a right-facing head.

Concerning other motifs, 1.7% or 21 out of total of 1254 seals having a unicorn,

Table 5.2: Catalogue of basic data of the Harappan seals having a right-facing animal (1)

CISI No.	Site	Motif	Object in front of animal	Pattern of arrangement	Direction of inscription animal motif	Crosswise (mm)=X	Lengthwise (mm)=Y	Thickness of boss (mm)	Thickness of boss (mm)	Type of boss	Feature of inscription (Mahadevan 1977)	Material	Remarks	Source
M-223	Mohenjodaro	Unicorn	script instead of staff	II	Right	22.3	21.5	-	-	-	342, 385, 162	Fired steatite		CISI Vol. 1
M-737	Mohenjodaro	Unicorn	with Staff	I	Right	30.5	30.5	-	-	-	? 59, 342, 1	Fired steatite	left part broken	CISI Vol. 2
M-738	Mohenjodaro	Unicorn	with Staff	I	Right	29.5	29.0	8.5	17.5	I	? 342, ? 341	Fired steatite	left upper part broken	CISI Vol. 2
M-749	Mohenjodaro	Unicorn	with Staff	I	Right	32.5	32.5	-	-	-	189, 104	Fired steatite		CISI Vol. 2
M-955	Mohenjodaro	Unicorn	without Staff ?	I	Right	18.5	18.5	-	-	-	102, 216, 123	Fired steatite		CISI Vol. 2
M-977	Mohenjodaro	Unicorn	-	I	Right	21.0	21.0	4.0	7.0	II	342, 387	Fired steatite	right lower part broken	CISI Vol. 2
M-1855	Mohenjodaro	Unicorn	without staff	I	Right	12.5	13.5	-	-	-	? ?	Fired steatite	only impression	CISI Vol. 3.1
H-60	Harappa	Unicorn	with staff	II	Right	27.8	27.5	-	-	-	102, 287, 342, 242, 391, 100	Fired steatite		CISI Vol. 1
H-73	Harappa	Unicorn	without staff	I	Right	22.0	21.5	-	-	-	70, 12	Fired steatite		CISI Vol. 1
L-44	Lothal	Unicorn	?	I	Right	20.0	17.0	4.0	-	ring-shaped	93 ?	Copper	very coarse depicted	CISI Vol. 1
K-3	Kalibangan	Unicorn	without staff	I	Right	37.0	35.0	10.0	-	broken	-	Terracotta ?	very coarse depicted	CISI Vol. 1
K-6	Kalibangan	Unicorn	with staff	I	Right	29.8	29.5	3.0	10.0	I	242, 216, 391, 267, 402, 242, 342, 341	Fired steatite		CISI Vol. 1
K-16	Kalibangan	Unicorn	with staff	I	Right	23.5	23.5	-	-	-	67, 342, 1, 391, 124	Fired steatite		CISI Vol. 1
K-17	Kalibangan	Unicorn	with staff	I	Right	23.3	23.3	-	-	-	228, 342	Fired steatite		CISI Vol. 1
K-18	Kalibangan	Unicorn	with staff	II	Right	28.3	28.8	-	-	-	17, 230, 100, 356, 180	Fired steatite		CISI Vol. 1
K-26	Kalibangan	Unicorn	script instead of staff	II	Right	29.0	29.0	-	-	-	326, 342	Fired steatite		CISI Vol. 1
C-17	Chanudaro	Unicorn	human figure instead of staff	II	Right	21.0	20.5	-	-	-	8, 342, 1	Fired steatite		CISI Vol. 1
B-1	Barawali	Unicorn	with staff	I	Right	34.0	34.5	-	-	I	391, 391, 216, 402, 99, 99, 342, 1	Fired steatite		CISI Vol. 1
B-3	Barawali	Unicorn	script instead of staff	II	Right	14.8	14.8	-	-	-	105, 59, 211	Fired steatite		CISI Vol. 1
-	Farmna	unicorn	script instead of staff	II	Right	21.3	21.0	4.3	12.5	II	67, 59, 211	Fired steatite		Konaukawa et al. 2011
-	Bhirrana	unicorn	-	I	Right	22.5	21.5	5.0	9.0	II	253, 230, 211	Fired steatite		Kumar and Dangi 2006
K-27	Kalibangan	Urus	without staff	II	Right	15.0	14.5	-	-	II	267, 99	Fired steatite		CISI Vol. 1
B-4	Barawali	Urus	script instead of staff	II	Right	15.8	15.8	-	-	-	53, 342, 162	Fired steatite		CISI Vol. 1
B-5	Barawali	Urus	-	I	Right	14.3	14.3	2.6	5.8	I	267, 99	Fired steatite		CISI Vol. 1
Blk-5	Bale-kot	Urus	script instead of staff	II	Right	21.0	20.0	3.5	10.0	II	171, 211	Fired steatite		CISI Vol. 2
-	Dholavira	Bison (Antelope ?)	without manger	III	Right	30.0	30.0	7.0	-	-	-	Fired steatite		NHK and NHK Promotions 2000
H-85	Harappa	Zebu	-	I	Right	25.3	25.3	-	-	-	211, 59, 59, 267	Fired steatite	lower half broken	CISI Vol. 1
M-269	Mohenjodaro	Buffalo	without manger	I	Right	22.8	22.3	-	-	-	204, 245, 342	Fired steatite		CISI Vol. 1
M-270	Mohenjodaro	Buffalo	without manger	III	Right	22.0	23.5	4.0	10.5	II	-	Fired steatite		CISI Vol. 1
M-1124	Mohenjodaro	Buffalo	with manger	-	Right	-	-	-	-	-	?	Fired steatite	broken piece	CISI Vol. 2
B-7	Barawali	Buffalo	without manger	I	Right	22.8	21.8	3.5	7.2	II	267, 99	Fired steatite		CISI Vol. 1
-	Farmna	Buffalo	script instead of manger	II	Right	20.0	20.0	6.0	11.5	II	87, 59, 211	Fired steatite		Konaukawa et al. 2011

Table 5.2: Catalogue of basic data of the Harappan seals having a right-facing animal (2)

CISI No.	Site	Motif	Object in front of animal	Pattern of motifs arrangement	Direction of head of a main animal motif	Crosswise (mm)=X	Lengthwise (mm)=Y	Thickness excluding boss (mm)	Thickness including boss (mm)	Type of boss	Feature of inscription (Mahadevan 1977)	Material	Remarks	Source
-	Bhirrana	Buffalo	without manger	II	Right	21.0	20.0	-	-	-	162, 102, 102	Fired steatite		Rao et al. 2004
M-271	Mohenjodaro	Goat	-	III	body to left, head turned back to Right	15.0	14.5	-	-	-	-	Fired steatite		CISI Vol. 1
M-272	Mohenjodaro	Goat	-	II	body to Right, head turned back to left	25.3	24.5	-	-	-	284, 100	Fired steatite		CISI Vol. 1
M-273	Mohenjodaro	Goat	-	II	Right	21.0	19.8	-	-	-	326	Fired steatite		CISI Vol. 1
M-1129	Mohenjodaro	Goat	Indus script	II	Right	24.5	23.5	-	-	-	? 342, 180, 342, 214	Fired steatite	coarse depicted	CISI Vol. 2
K-34	Kalibangan	Goat	Indus script	II	Right	8.5	8.5	-	-	II	59	Fired steatite		CISI Vol. 1
O-23	Chanhudaro	Goat	-	II	Right	27.0	26.0	-	-	II	86, 327, 100, 102, 381, 28, 180, (312, 303, 312), 180, 29, 267	Fired steatite		CISI Vol. 1
B-8	Barawali	Goat	-	I	Right	21.0	20.5	3.5	7.0	II	124, 342	Fired steatite		CISI Vol. 1
B-9	Barawali	Goat	-	I	Right	22.5	20.5	4.5	8.0	II	104, 162	Fired steatite		CISI Vol. 1
B-10	Barawali	Goat	Indus script	II	Right	14.3	12.5	3.1	6.9	II	110, 162	Fired steatite		CISI Vol. 1
B-12	Barawali	Goat	7 dots	II	Right	18.5	18.5	4.0	9.0	II	167, 112	Fired steatite		CISI Vol. 1
B-13	Barawali	Goat	-	-	Right	20.8	19.0	4.5	-	-	?	Fired steatite		CISI Vol. 1
-	Barawali	Goat (Antelope?)	-	II	Right	17.0	17.0	11.0	-	-	211, 97	Fired steatite		NHK and NHK Promotions 2000
-	Bhirrana	Goat	Indus script	II	Right	18.0	18.0	-	-	-	108, 162	Fired steatite		Rao et al. 2004
K-40	Kalibangan	Elephant	-	I	Right	21.5	22.0	-	-	-	341, 127, 373, 373, 267, 100, 86, 347	Fired steatite		CISI Vol. 1
K-41	Kalibangan	Tiger	without manger	-	Right	34.0	34.0	-	-	-	-	Fired steatite	upper half broken	CISI Vol. 1
M-1134	Mohenjodaro	Rhinoceros	without manger	I	Right	38.0	37.5	-	-	I	391, 252, 381?, 219	Fired steatite		CISI Vol. 2
M-1139	Mohenjodaro	Rhinoceros	-	I	Right	20.5	20.5	5.0	10.0	II	391, 245, 99, 173, 342	Fired steatite	lower part broken	CISI Vol. 2
M-1911	Mohenjodaro	Rhinoceros	without manger	I	Right	18.0	18.0	-	-	-	391, 99, 228, 162, 242	Fired steatite	only impression	CISI Vol. 3.1
B-15	Barawali	Rhinoceros	without manger	I	Right	19.0	19.0	6.5	11.8	II	267, 99	Fired steatite		CISI Vol. 1
B-16	Barawali	Rhinoceros	-	-	Right	25.5	25.5	10.0	-	-	?	Fired steatite	broken piece	CISI Vol. 1
M-298	Mohenjodaro	Triple-headed animal	-	III	Right	23.0	22.3	-	-	-	-	Fired steatite		CISI Vol. 1
M-1170	Mohenjodaro	Triple-headed animal	-	II	Right	27.0	27.0	4.0	9.0	II	165	Fired steatite		CISI Vol. 2
K-43	Kalibangan	Triple-headed animal	-	II	Right	25.0	24.5	-	-	-	344, 53, 53, 344, 103, ?, 347, 342	Fired steatite		CISI Vol. 1
Al-6	Amri	Triple-headed animal	-	III	Right	28.0	28.5	-	-	I ?	-	Fired steatite		CISI Vol. 2
-	Bhirrana	Triple-headed animal	-	II	Right	20.0	20.5	-	-	-	?, 342	Fired steatite		Rao et al. 2004
-	Dholavira	Triple-headed animal	-	II	Right	20.0	20.0	10.0	-	-	167	Fired steatite		NHK and NHK Promotions 2000
B-17	Barawali	Horned tiger	with staff	I	Right	30.5	29.5	7.9	17.8	I	43, 180, 99, 66	Fired steatite		CISI Vol. 1
M-1026	Mohenjodaro	broken bovid	-	I	Right	23.0	23.0	8.0	16.0	I ?	?, ?, 12	Fired steatite	very coarse depicted (unfinished?), broken piece	CISI Vol. 2
M-1130	Mohenjo Daro	Unidentified animal	with staff	-	-	-	-	-	-	-	?	Fired steatite	very coarse depicted, broken piece	CISI Vol. 2

Table 5.3: Catalogue of basic data of the Harappan seals having a right-facing animal (3)

CISI No.	Site	Motif	Object in front of animal	Pattern of motifs arrangement	Direction of head of a main animal motif	Crosswise (mm)-X	Lengthwise (mm)-Y	Thickness excluding boss (mm)	Thickness including boss (mm)	Type of boss	Feature of inscription (Mahadevan 1977)	Material	Remarks	Source
H-1676	Harappa	Unidentified animal	–	I	Right	–	–	–	–	–	? 21, 130?	Fired steatite	broken piece	CISI Vol. 3.1
H-1688	Harappa	broken bovid	–	I	Right	23.5	23.5	–	–	–	328. ?	Fired steatite	broken piece	CISI Vol. 3.1
B-6	Banawali	Unidentified animal	–	–	Right	–	–	–	–	–	?	Fired steatite	broken piece	CISI Vol. 1
B-14	Banawali	Unidentified animal	fish sign (script ?)	–	Right	17.0	17.0	–	–	–	?	Fired steatite	broken piece	CISI Vol. 1
B-18	Banawali	Unidentified animal	–	–	Right	–	–	6.5	–	–	267, 99, 230. ?	Fired steatite	broken piece	CISI Vol. 1
Ad-8	Allandino	Unidentified animal	with stuff	I	Right	35.5	35.0	–	–	–	342, 127, 204, 267, 1	Fired steatite	very coarse depicted	CISI Vol. 2
M-312	Mohenjodaro	Human figure (s) and animal (s)	–	III	Right (Buffale)	25.0	21.0	–	–	–	–	Fired steatite	–	CISI Vol. 1
M-1918	Mohenjodaro	Human figure (s) and animal (s)	Indus script	II	Right	31.5	31.5	–	–	–	? 21, 242	Fired steatite	only impression	CISI Vol. 3.1
K-49	Kalibangan	Human figure (s) and animal (s)	–	II	Right	32.8	32.5	–	–	–	102, 112, 12	Fired steatite	–	CISI Vol. 1
C-27	Chanhudaro	Human figure (s) and animal (s)	–	–	body to Right, head turned back to left	27.3	27.3	–	–	–	?	Fired steatite	upper part broken	CISI Vol. 1
–	Banawali	Human figure (s) and animal (s)	Indus script	II	Right (Buffale)	30.0	30.0	11.0	–	–	97, 211	Fired steatite	–	NHK and NHK Promotions 2000
–	Dholavira	1 human and triple-headed animal	–	III	Right	18.0	18.0	10.0	–	–	–	Fired steatite	–	NHK and NHK Promotions 2000
K-50	Kalibangan	Horned deity-C	–	I	Right	19.0	19.0	3.5	8.0	II	162, 104	Fired steatite	–	CISI Vol. 1
Ns-9	Nausharo	Horned deity-C	–	I	Right	23.5	23.0	–	–	–	375, 204, 175, 180, 400, 99, 342, 25, 99	Fired steatite	–	CISI Vol. 2

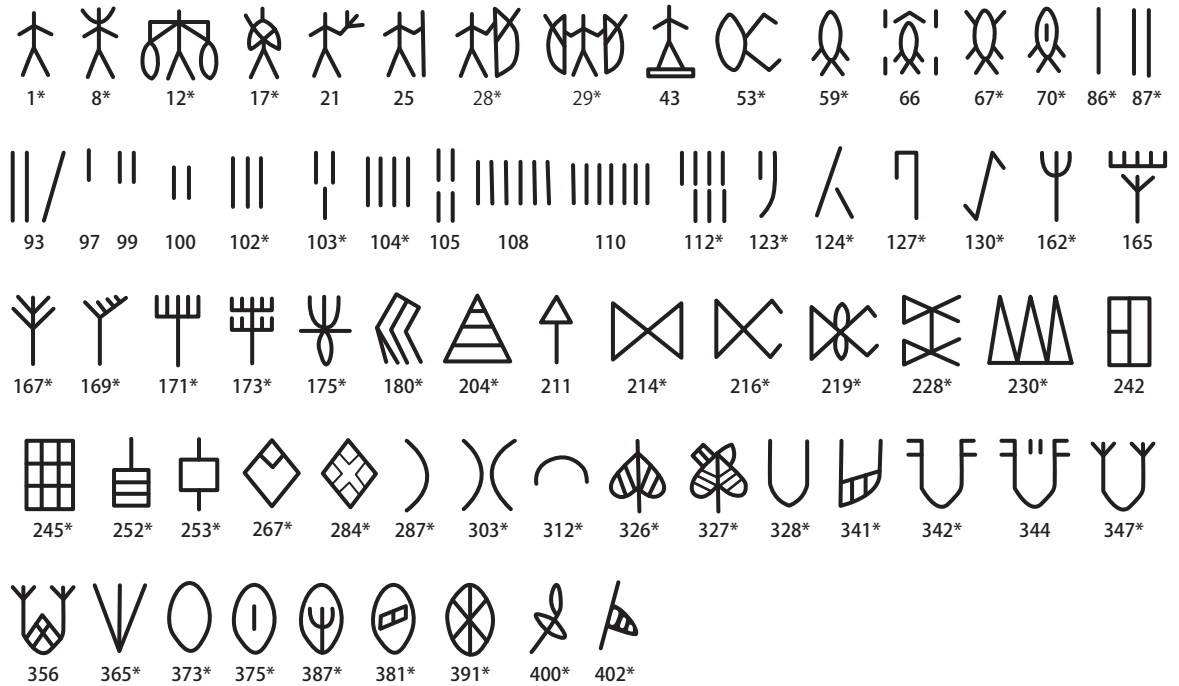


Figure 5.3: Harappan scripts used in the Harappan seals having a right-facing animal

1.2% or 1 out of total of 84 seals having a bison, 3.6% or 2 out of total of 55 seals having a zebu are characterized by a left-facing head. The motifs composed by human figure

As is indicated by this analysis, it can be pointed out that the percentage of right-facing animal is different in each motif.

4-II. Harappan scripts

Harappan scripts used in the Harappan seals having a right-facing animal are restricted in only 71 letters (Figure 5.3).

There are many examples sharing common Harappan script (s) in the Harappan seals having a right-facing animal. Especially, the seals having a right-facing animal excavated in the Ghaggar basin are characterized by common Harappan script such as a diamond-shaped letter, a fish-like letter, a spear-like letter, a dot-shaped letter which is comprised of several dots and a tree-like letter (Figure 5.4) ⁽⁵⁾.

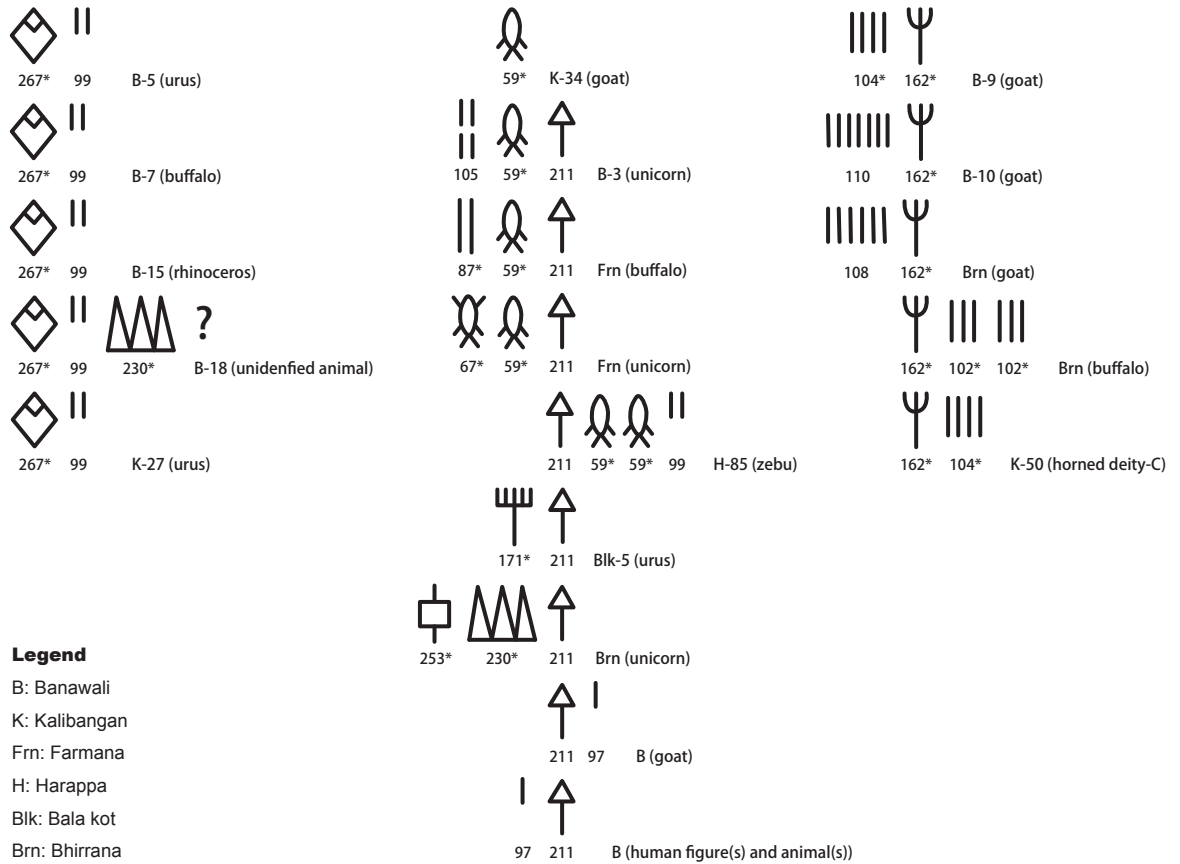


Figure 5.4: Common Harappan scripts shared in the Harappan seals having a right-facing animal

Furthermore, same scripts, which are characterized in the Ghaggar basin, are observed in the Harappan seals discovered from Harappa (H-85) and Bala-kot (Blk-5). In connection with this point, it can be pointed out that the Harappan seals having a right-facing animal are organized along with some specific Harappan scripts and shared in a broad area extending throughout this urbanized society.

In comparing with the Harappan scripts engraved on the Harappan seals having a left-facing animal, it is most likely that the scripts engraved on the Harappan seals having a right-facing animal are not expressed in reverse.

4-III. Arrangement pattern of the motif

As far as arrangement pattern of the motif is concerned, the Harappan seals

Legend (for Fig. 5.5)

- Buffalo
- Elephant
- Multi-headed animal
- Unicorn
- ◇ Composite animal
- ◆ Zebu
- △ Rhinoceros
- ▲ Goat
- ▲ Tiger
- + Other bovine (urus)
- Other motifs
- Composite human figure (Horned deity)
- Human figure (s) and Animal (s)

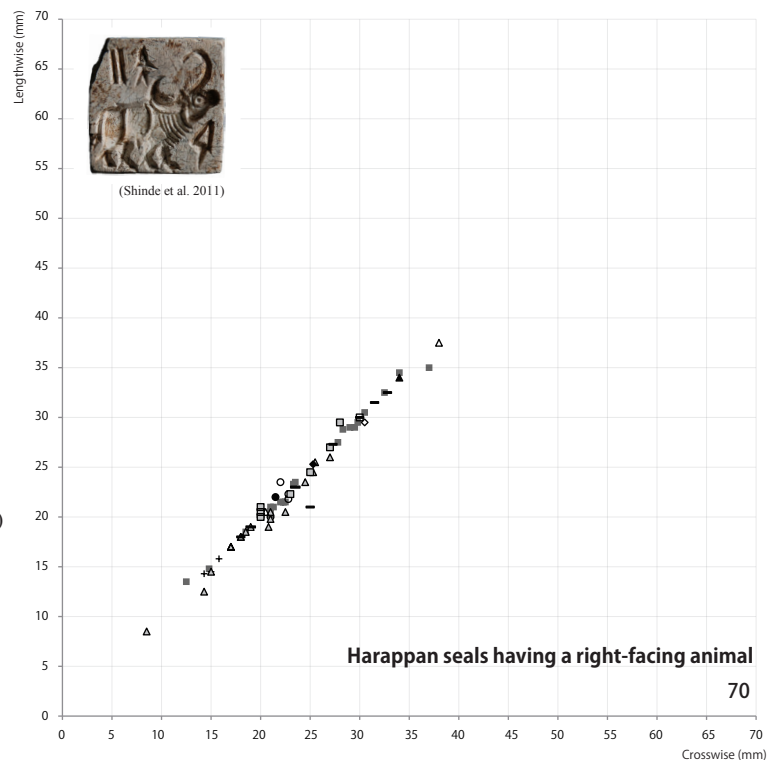


Figure 5.5: Scatter plot of the measurement of Harappan seals having a right-facing animal

having a right-facing animal are characterized by Pattern II rather than Pattern I (i.e. Pattern I: 42.9 %, Pattern II: 46 % and Pattern III: 11.1 %) (Figure 5.2). In other words, it is interesting to note that the majority of the Harappan seals having a right-facing animal is characterized by Patterns II or III.

4-IV. Type of boss

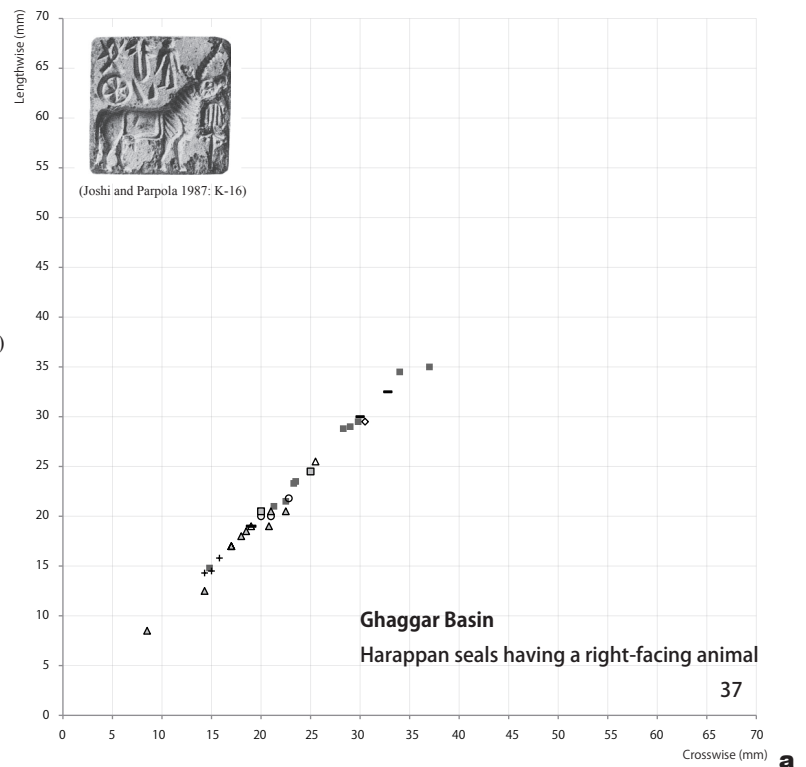
As is indicated by my observation, the type of boss is also different from the Harappan seals having a left-facing animal motif. The Harappan seals having a right-facing animal have a square- or a bullnose square-shaped boss without an incised central line, defined as Type II (Figure 5.2).

4-V. Size of the seals

A graph (Figure 5.5) shows that the scatter plots of size of the Harappan seals having a right-facing animal. In comparing with a catter plots of size of the Harappan

Legend (for Fig. 5.6a)

- Buffalo
- Multi-headed animal
- Unicorn
- ◇ Composite animal
- △ Rhinoceros
- ▲ Goat
- + Other bovine (urus)
- Composite human figure (Horned deity)
- Human figure (s) and Animal (s)



Legend (for Fig. 5.6b)

- Buffalo
- Multi-headed animal
- Unicorn
- ◇ Composite animal
- △ Rhinoceros
- ▲ Goat
- + Other bovine (urus)
- Human figure (s) and Animal (s)

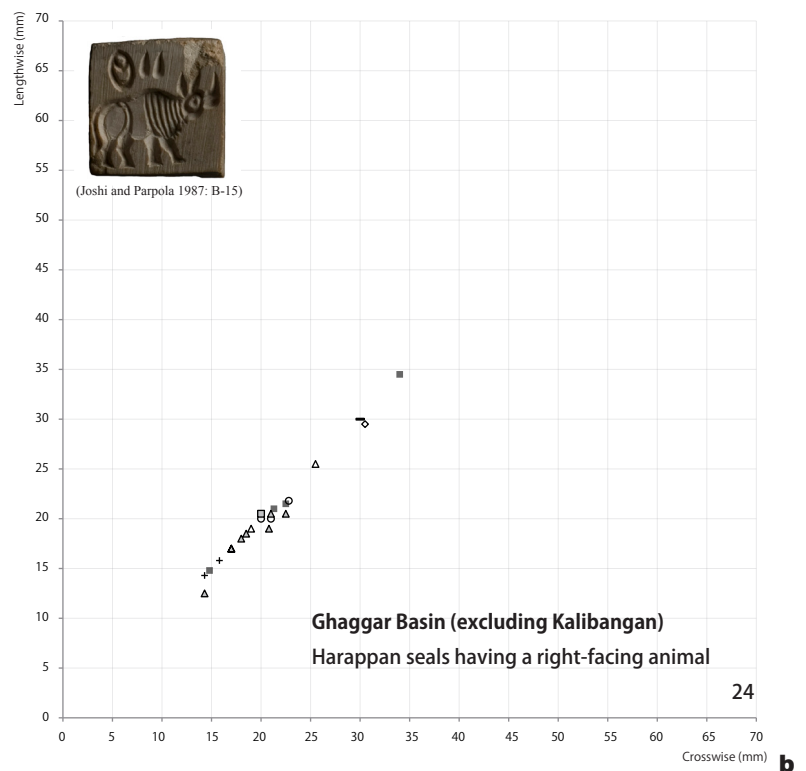


Figure 5.6a & 5.6b: Scatter plot of the measurement of Harappan seals having a right-facing animal (6a: Ghaggar Basin, 6b: Ghaggar Basin excluding Kalibangan)

seals having a unicon motif (Figure 4.8b), there are clear differences between them. Broadly speaking, the large-size category, more than 50.0mm (i.e. A-5 and A-4), is absent in the case of the Harappan seals having a right-facing animal. Almost of the seals belong to 35.0mm to 15.0mm size-categories. In connection with this point, it can be pointed out that the Harappan seals having a right-facing animal from the Ghaggar basin (Figure 5.6) concentrate in small-size category, less than 25.0mm.

4-VI. Distribution pattern

As presented in Figure 5.7, the distribution pattern of the Harappan seals having a right-facing animal is very distinctive. As is indicated by this figure, it is emphasized clearly that the Harappan seals having a right-facing animal concentrated in the Ghaggar Basin.

Although the other regions are characterized by the high percentage of the Harappan seals having a left-facing animal, 75% or 24 out of total of 32 seals has a right-facing animal in the Ghaggar Basin (excluding Kalibangan). Particularly, in Banawali 90% or 18 out of total of 20 seals has a right-facing animal. In Kalibangan, which had a strong relationship with the Harappan culture in comparison with other Indus sites in this region and same city plan with Mohenjodaro, 28.3% or 13 out of total of 46 seals has a right-facing animal. Judging from this percentage, it can be assumed that Kalibangan is understood as an intermediate site between the regions characterized by the seals having a left-facing animal and the regions characterized by a right-facing animal.

On the other hand, the percentage of the Harappan seals having a right-facing animal is 2.6% or 28 out of total of 1081 seals in Sindh, 6.2% or 4 out of total of 65 seals in Gujarat and 12.5% or 1 out of total of 8 seals in Balochistan region. As far as the percentage of the Harappan seals having a right-facing animal is concerned in Mohenjodaro and Harappa, 2.1% or 22 out of total of 1038 seals in Mohenjodaro and 1.1% or 4 out of total of 347 seals in Harappa, respectively. In conclusion, it should be



Figure 5.7: Distribution pattern of the Harappan seals having a right-facing animal

mentioned that the Harappan seals having a right-facing animal are a special feature in the Ghaggar Basin.

Furthermore, as is indicated by the study of M. Koiso (Koiso 2005), the Harappan seals discovered from outside the Greater Indus valley are characterized by a left-facing animal, not a right-facing animal ⁶. And a Harappan seal having a left-facing rhinoceros is discovered at Shortugai in Afghanistan.

Concerning the distribution pattern of the sealings, 16 sealings discovered from the Ghaggar basin, 31.2% or 5 out of total of 16 sealings has a left-facing animal as the impression (s), which originated from the Harappan seals having a right-facing animal (3 sealings are from Kalibangan and 2 sealings are from Farmana).

5. Discussion

5-1. Design of the Harappan seal

Assuming the design depicted on the surface of Harappan seals is not just an aggregate of the motifs but arranged under a secure rule, we can grasp a standard of design or a rule for arranging each motif. The arrangement pattern of the motifs is focused on here again to understand a rule for arranging each motif of the surface. It is clearly that 95.7% or 1388 out of total of 1451 seals is expressed as Pattern I (Figure 5.2). As is indicated by this analysis, it has to be noted that a basic rule of the arrangement pattern of the motif is very strict. In the connection of this point, it should be noted that Pattern I is basically expressed along with a left-facing animal as a main motif and a Type I boss.

As a conclusion, it is interesting to note that a rule of the design of the Harappan seals is based on 'Motifs consisting of a left-facing animal and Harappan scripts, etc. are arranged in Pattern I with a Type I boss'. I evaluate here this strict rule as the design of the Harappan seals, and call the seal designed by this rule as 'Type A seal' in this study.

In the formation phase of this design, it is also noteworthy that a specific

selecting process, that certain painted motifs of pottery (i.e. humped bull etc.) are adopted as the engraving motifs on the Harappan seals, is confirmed ⁽⁷⁾. This specific phenomena means that the establishment of the design of the Harappan seals is simultaneous with the beginning of proper use of specific main motifs of the Harappan seals and specific painting motifs of Harappan painted pottery (Konasukawa 2007, 2008a, 2008b). As the analysis describes, it can be pointed out that this design of the Harappan seals deeply relates to a rule of the usage of specific symbols throughout the urbanized society of the Harappan Civilization.

5-II. Significance of the Harappan seals having a right-facing animal

As is indicated by the results of recent excavations, another type of the Harappan seals has been reported. This type is characterized by a right-facing animal as a main motif engraved on the surface, not a left-facing animal. There are 74 seals having a right-facing animal. As is discussed in this chapter, it is noteworthy that the Harappan seals having a right-facing animal have some different features from Type A seals. Those differences are chiefly seen in the motifs, Harappan scripts, type of boss and distribution pattern. As far as the distribution pattern is concerned, it is clear from the above analysis that the seals having a right-facing animal are concentrated in the Ghaggar Basin (Figure 5.7). In connection with this point, it can be pointed out that the majority of this type of seals is characterized by Pattern II, the high percentage of sharing common Harappan scripts and a type II boss, not a type I boss (Figure 5.2).

Concerning a specific feature in each motif, it is worth mentioning here that 60% or 12 out of total of 20 seals having a goat motif concentrates in the Ghaggar Basin and the majority of them is characterized by a right-facing goat (66.6% or 8 out of total of 12 seals having a right-facing goat). It is presumed that this specific feature means that the motif of goat is a special one in the Ghaggar Basin. As compared with other motifs, although the majority of motifs such as unicorn, bison and zebu are expressed in the left direction, the majority of motifs consisting of goat, three headed animal, buffalo

and urus, is expressed in right direction. It may be possible that this feature shows an important clue for considering the different meanings of each motif.

The results of this chapter lead to an important conclusion that the seals having a right-facing animal are very likely to show the regional variation or diversity of the Harappan seals, which has not been pointed out so far ⁽⁸⁾. Concerning the high percentage of shared or common scripts in the Harappan seals having a right-facing animal, which are discovered in the Ghaggar Basin, it is important to note that these seals had functioned under a different rule of the design in comparing with Type A seals. The Harappan seal designed by this rule are referred to as 'Type B seal' in this study.

As is described by the analysis in this paper, it is assumed that the majority of the Harappan seals comprise of Type A and Type B seals. But it can be pointed out that there are Harappan seals regulated by another design, that had functioned regardless of the direction of the motif. The motifs constitute of some examples of composite human figure (subdivide into Horned deity-A and Horned deity-B), Human figure (s) and animal (s), other motifs, geometrical motifs and only scripts.

In conclusion, it can also be presumed that the Harappan seals had functioned under the three designs, namely Type A, Type B and another one in the urbanized society of the Harappan Civilization. It is clear from the above analysis that it is a very important approach to consider the design of the Harappan seals in order to better understand the patterns of their usage.

6. Chapter conclusion

As is indicated by the analysis of this chapter, it has to be noted that a basic rule of the arrangement pattern of the motifs is very strict. It should be noted that Pattern I is basically expressed along with a left-facing animal as a main motif and a Type I boss. As a conclusion, it is interesting to note that a rule of the design of the Harappan seals is based on 'motifs consisting of a left-facing animal and Indus scripts, etc., arranged in

Pattern I with a Type I boss’.

This strict rule (as a specific design of the Harappan seals) is evaluated here, and the seals designed by this rule are referred to as ‘Type A seal’ in this study.

Concerning the Harappan seals having a right-facing animal, they have some different features from Type A seal. Those differences are prominently visible in certain aspects such as motifs, Harappan scripts, type of boss and distribution pattern. As far as the distribution pattern is concerned, it is clear from the above analysis that the Harappan seals having a right-facing animal are concentrated in the Ghaggar Basin. It can be pointed out that the majority of the Harappan seals with a right-facing animal are characterized by Pattern II, the high percentage of sharing common Harappan scripts and a Type II boss, not a Type I boss.

The results of this chapter lead to the conclusion that the Harappan seals having a right-facing animal are very likely to show regional variation or diversity of the Harappan seals. Previous studies have not emphasized on this aspect so far. With regard to the high percentage of common Harappan scripts shared between the seals having a right-facing animal, which are discovered in the Ghaggar Basin, it is important to note that these Harappan seals had functioned under a different rule of the design in comparison with Type A seals.

Notes

1) As mentioned in the earlier part of this study, though typological study of the Harappan seals is very important, I could not consider the matter in this study because the published data having proper context data is not sufficient. But it is most likely that the specific patterns, which are obtained from the comprehensive study on published data, reflect some aspects of the structure of Harappan seals.

2) M. Noguchi studied and classified the bosses of the Harappan seals hypothetically (Noguchi 2003). But it is mentioned here that his typological sequence of the bosses should be re-examined after the accumulation of enough examples from a clear archaeological context.

3) In this study, the Harappan seals discovered from outside the Greater Indus region are excluded from basic data for the analysis. However, they are referred to in the discussion about the direction of animal's head which is depicted on the seals, when relevant. In addition, future work by the present author will revisit these seals in a more comprehensive manner after publication of the new volumes of *the CISI*.

4) Sealings will be addressed in a future study since three sealings from Farmana (Figures 1.7 to 1.10) and one sealing from Kunal (Figures 3.4 and 3.7) were examined.

5) I have to discuss the arrangement pattern and frequency of the appearance of common Harappan script to understand the specific feature of Harappan scripts in a full sense. In this study, I just point out that the Harappan seals having a right-facing animal discovered in the Ghaggar basin tend to share some specific common Harappan script(s).

6) The Harappan seals or the seals related with them had been discovered from Tello, Nippur, Kish, Ur, Altyn Depe, etc. (Kosio 2005) so far. Those 14 seals have a unicorn and a zebu motif, etc. as a main motif respectively (Kosio 2005). As far as the sealings of the Harappan seals are concerned, one is reported from Umma and another one is reported from Tepe Yahya (Kosio 2005). Although figures and photographs are not clear, it can also be noted that the direction of the head of animal, which depicted on the seals, faces left. And I should discuss about the Persian type seals and the Dilmun type seals, that may have had a relationship with the Harappan seal as another study in future. I discussed both types of seal to consider the chronological position of the Harappan seals by comparative study (Konasukawa 2007). T. Goto also discussed them to study some imported artifacts from the outside of the Harappan territory (Goto 1999).

7) The selecting of specific painted motifs of pottery as the engraved motifs on the seals is also recognized in the period ranging from Ubaid to Ur (Thuesen 1992). It is very interesting that the rearrangement of specific symbols, which is based on the same system, is recognized in the formative phase of the urbanized society in Harappan and Mesopotamia Civilizations.

8) The chronological position of the Harappan seals having a right-facing animal should be discussed in a full sense after the accumulation of enough data.

Chapter 6

Comparative analysis of the seals in the Pre-/Early Harappan period
and the Harappan seals through SEM and 3D analyses

Chapter 6 - Comparative analysis of the seals in the Pre-/Early Harappan period and the Harappan seals through SEM and 3D analyses

Chapter introduction

Chapter 6 will discuss the manufacture techniques of the seals through SEM and 3D analyses. This study aims at understanding the sequence of the carving techniques of the seals in the Pre-/Early Harappan period, and the Harappan seals and the convex type Harappan seal, furthermore the difference of the carving techniques among the Harappan seals, namely Type A and Type B seals.

1. Background and aims

Although the study of the Harappan seals forms the most important aspect of Harappan archaeology, it can be mentioned that the previous studies have been limited in the classification and interpretation of the motifs depicted on the surface of the seals and the decipherment of Indus scripts (see also Chapter 2).

Concerning the discussion about manufacture or carving techniques of the Harappan seals, it is confined to E.J.H. Mackay's perspectives (Mackay 1931). Based on the unfinished seals and the seals which are abandoned in the middle of the manufacture process from Mohenjodaro and Harappa, it can be estimated that a manufacture sequence of the seals was as follows; ① to procure the steatite blocks → ② to crack and cut the steatite roughly → ③ to carve the boss and bore it → ④ to polish the all of surface → ⑤ to carve the motifs → ⑥ to carve the letters → (⑦ dispensation) → ⑧ firing ⁽¹⁾ → ⑨ use and abandon. But the details of their making system are still unknown.

Recently, re-thinking of the carving techniques, which is based on the result of

excavations at Harappa (Kenoyer & Meadow 2010) and the discussions of the carving techniques and manufacture sequence of the seals through SEM or 3D analysis (Green 2011) were started. Concerning the SEM analysis of the seals, although a team of the University of Wisconsin has initiated the analysis, the results are still not published. In the excavation report of Farmana (Shinde et al. 2011), the tentative results of the SEM analysis of four Harappan seals, which were discovered from this site, were published and some tentative opinions about the carving techniques and the tools for making the seals were described (Konasukawa et al. 2011). This report, including some SEM images, was the first published discussion about the SEM analysis of the Harappan seals. In this instance, it can be said that this study, including even the establishment of the analytical method, is one of the important subjects on the study of the Harappan seals in the future ⁽²⁾.

In this study, the author observed the manufacture technique, especially the carving technique, of some Harappan seals through the SEM and summed up the results and future directions (Konasukawa 2012a). Although the observed samples are a few up to now, it has been explained partially through the SEM that various carving techniques and tools had been used to carve the motifs, which are depicted on the surface of the Harappan seals (Konasukawa 2012a, 2012c).

In this Chapter 6, the author presents the results of previous observations about the carving techniques to make the motifs on the surface of the Harappan seals through SEM and 3D (PEAKIT) (will be described in later part) analyses, that have not been discussed so far. The aims of this Chapter are as follows;

- (1) To present the basic data about the carving techniques of the seals in the Pre-/Early Harappan period and the Harappan seals and interpret them hypothetically,
- (2) To discuss the carving techniques of the seals in the Pre-/Early Harappan period, and whether they succeeded into those of the Harappan seals, or not,
- (3) To discuss about the presence or absence of regional variations among the carving

techniques of the Harappan seals.

2. Basic data for the analyses in this Chapter

2-I. The seals in the Pre-/Early Harappan period

The data for the analyses comprise of three fired steatite seals, which are discovered from the period IC(i) of Kunal (Table 6.1). As mentioned in Chapter 3, the chronological position of the seals can be put into the later part of the Pre-/Early Harappan period (ca. 2800 to 2600 BCE).

The motifs of the seals include geometrical ones, which comprise of straight lines (Figures 6.9 and 6.16, see also Figure 3.1-2, 6) or group of concentric circles (Figures 6.4 and 6.5, see also Figure 3.1-1) and animal motifs, comprising two deer or ibexes (Figure 6.4, see also Figure 3.1-1).

Based on observation by the naked eye, the various carving marks of the motifs, which consist of straight or curved lines, are confirmed. Each motif are carved delicately, especially animal ones, and evoke the realistic nature of the animal. According to the shapes of their horns, the animal motif can be distinguished between male and female. And concerning the motif of concentric circles, they could be carved by a different technique in comparison with other parts because there is no joining point in each concentric circle.

2-II. Harappan seals

The data comprises four Harappan seals from Farmana (Figures 6.27, 6.31, 6.35 and 6.39, see also Figure 1.1-1, 2, 4 and 5), eleven Harappan seals from Banawali (Figures 6.45, 6.48, 6.52, 6.55, 6.57, 6.61, 6.65, 6.69, 6.73, 6.74 and 6.75, see also Figure 1.2, 1.3, 1.4-2), four Harappan seals from Mohenjodaro (Figures 6.79, 6.85, 6.91 and 6.94) and one Harappan seal stored in the Okayama Orient Museum (Figure 6.20, see also Figure 1.1-3) (Table 6.1). All of the seals excluding one example of the Okayama Orient Museum are excavated artifacts from the Mature Harappan period.

Table 6.1: Catalogue of the basic data for the analyses in the present study

Serial No.	OISl No.	Site	Motif	Direction of the head of the motif	Section of the animal motif's body	Mean value of the depth of the carving marks: A and B (mm)	Mean value of the depth of the carving marks: C and D (mm)	Maximum depth of the animal motif's body (mm)	Arrangement of the pattern of the motifs	Type of boss	Crosswise (mm)	Lengthwise (mm)	Thickness excluding boss (mm)	Thickness including boss (mm)	Material	Source
1	-	Kunal	Geometric motif	-	-	0.56 (0.75/0.3)	-	-	-	Cylinder	20.5	20.3	3.0	6.1	Fired steatite	Acharya 2008, 15
2	-	Kunal	Group of concentric circles and cross	-	-	0.637 (1.00/0.27)	0.733 (1.27/0.33) *only C	-	-	-	maximum diameter = 28.5	maximum diameter = 28.5	3.9	-	Fired steatite	Acharya 2008, 15
3	-	Kunal	Two deers or ibexes	-	Squarish	0.803 (1.27/0.27)	-	1.33	-	-	maximum diameter = 28.5	maximum diameter = 28.5	3.9	-	Fired steatite	Acharya 2008, 15
4	-	Kunal	Geometric motif	-	-	0.536 (0.9/0.1)	-	-	-	Cylinder	13.0	13.9	2.3	5.0	Fired steatite	Acharya 2008, 15
5	-	-	Unicorn	Left	Concave	0.807 (1.0/0.2)	1.025 (1.05/1.0)	2.50	I	I	24.1	25.0	8.0	15.0	Fired steatite	Konasukawa 2011a, 2012a
6	M-1123	Mohenjodaro	Zebu	Left	Concave	0.634 (0.8/0.33)	1.33 (1.33/-)	2.13	I	I	23.5	23.0	7.8	13.9	Fired steatite	OISl Vol. 2
7	M-802	Mohenjodaro	Unicorn	Left	Concave	0.704 (0.99/0.53)	-	2.00	I	I	26.5	27.0	9.0	13.9	Fired steatite	OISl Vol. 2
8	-	Farmana	Zebu	Left	Concave	0.652 (0.8/0.33)	1.000 (1.0/-)	2.86	I	I	28.0	28.0	7.0	13.0	Fired steatite	Konasukawa et al. 2011
9	-	Farmana	Unicorn	Left	Concave	0.715 (1.07/0.4)	-	2.33	I	Two Indus letters	27.0	26.5	7.2	13.0	Fired steatite	Konasukawa et al. 2011
10	M-1114	Mohenjodaro	Zebu	Left	Concave	0.849 (1.33/0.33)	1.577 (2.2/1.2)	2.86	I	I	30.5	30.5	7.9	12.1	Fired steatite	OISl Vol. 2
11	B-2	Banawali	Unicorn	Left	Concave	0.638 (0.73/0.53)	0.684 (0.73/0.6)	2.86	I	I	30.5	30.5	8.5	17.0	Fired steatite	OISl Vol. 1
12	B-17	Banawali	Horned tiger	Right	-	0.733 (1.33/0.4)	1.059 (1.47/0.8)	2.86	I	I	30.5	29.5	7.9	17.8	Fired steatite	OISl Vol. 1
13	M-738	Mohenjodaro	Unicorn	Right	Concave-squarish	1.079 (1.47/0.6)	1.3 (1.47/1.2)	3.33	I	I	29.5	29.0	8.5	17.5	Fired steatite	OISl Vol. 2
14	B-13	Banawali	Goat	Right	Concave-squarish	0.738 (0.738/0.5)	-	1.50	-	-	20.8	19.0	4.5	-	Fired steatite	OISl Vol. 1
15	B-11	Banawali	Goat	Left	Squarish	0.529 (0.7/0.25)	-	0.90	II	II	13.5	13.5	3.8	7.8	Fired steatite	OISl Vol. 1
16	-	Farmana	Buffalo	Right	Squarish	0.614 (1.0/0.15)	1.238 (1.5/0.95)	2.00	II	II	20.0	20.0	6.0	11.5	Fired steatite	Konasukawa et al. 2011
17	-	Farmana	Unicorn	Right	Squarish	0.567 (0.8/0.2)	0.65 (0.75/0.95)	1.50	II	II	21.3	21.0	4.3	12.5	Fired steatite	Konasukawa et al. 2011
18	B-5	Banawali	Urus	Right	Squarish	0.439 (0.75/0.1)	-	1.00	I	I	14.3	14.3	2.6	5.8	Fired steatite	OISl Vol. 1
19	B-10	Banawali	Goat	Right	Squarish	0.385 (0.75/0.15)	-	1.20	II	II	14.3	12.5	3.1	6.9	Fired steatite	OISl Vol. 1
20	B-15	Banawali	Rhinoceros	Right	Squarish	0.568 (0.75/0.25)	1.000 (1.0/-)	1.25	I	II	19.0	19.0	6.5	11.8	Fired steatite	OISl Vol. 1
21	B-7	Banawali	Buffalo	Right	Squarish	0.775 (1.05/0.45)	0.85 (0.95/0.8)	2.00	I	II	22.8	21.8	3.5	7.2	Fired steatite	OISl Vol. 1
22	B-6	Banawali	Unidentified animal	Right	Squarish	0.508 (0.85/0.1)	-	1.50	-	-	*1.98	*1.52	*5.6	*1.0	Fired steatite	OISl Vol. 1
23	B-20	Banawali	Geometric motif	-	-	0.971 (1.25/0.6)	-	-	-	II	11.0	10.0	3.0	6.0	Fired steatite	OISl Vol. 1
24	B-21	Banawali	Indus scripts	-	-	1.061 (1.55/0.6)	-	-	-	-	26.9	13.1	-	9.0	Fired steatite	OISl Vol. 1

*Numerical value (mm) in parentheses in columns of mean value of the depth of carving marks A, B, C and D: maximum depth/minimum depth.

*Crosswise, lengthwise and thickness of serial No. 18: numerical value (mm) of the measurement of the broken parts. *Two Harappan letters are inscribed on the boss.

Concerning the seal stored in the Okayama Orient Museum, It was interpreted as a typical Harappan seal through the author's previous research (Konasukawa 2012a).

The motifs consist of animal motifs as a main motif (i.e. unicorn, zebu, buffalo, rhinoceros and goat), along with Indus scripts and staffs. In comparing these motifs with the motifs of the seals in Pre-/Early Harappan period (see Chapter 3), we can understand that the structure of the motif of typical Harappan seals is more complicated. This complication of the structure of motifs, is accompanied with a change of the design of the seals in the transitional period ranging from the Pre-/Early Harappan period to the Mature Harappan period, can be understood as the complication of the carving techniques in order to make the motifs (Konasukawa 2012c).

Based on the observation by the naked eye, the various carving marks of the motifs, which constitute of straight or curved lines, are confirmed. Each motif is carved delicately, especially animal motifs. Even anatomical detail is expressed in the realistic manner. According to the observation by the naked eye, we can understand that their carving techniques are on a high level of sophistication.

3. Method for the analyses

In this study I adapted the following research methods to observe the manufacture techniques of the seals.

- (1) Before the SEM analysis, silicon resin is poured into the depressions (i.e. carving marks and boring parts, etc.) of the seals to make the replica of the seal, which is then observed through the SEM,
- (2) in 3D analysis, firstly measurements of the seal's replica are taken, which is the same as that used in SEM analysis, by 3D scanner to make the PEAKIT image and then observe it after enlarging the image.

3-I. SEM analysis

I-A. SEM analysis

The SEM analysis (called as the Replica method in Japan) is originally as per the following method, that the researcher first pours silicon resin into the depressions of the pottery to make the replica, and then observes the surface of the replica through the microscope (Jinno and Tagawa 1991). The analysis based on this research method has been used and developed in the study of decoration tools, depression of leaves and grains, impurities of the pottery fabric and marks of manufacture techniques etc. Recently, SEM has been used for the observation of the above features and led to big successes for the studies about the impression of flora and seed, etc., because the depth of focus of the SEM is high and so suitable for the observations from low to high magnifying power. In the observation through the SEM, there are features, especially on the surface of the artifacts, which can be observed clearly even at approximately 15 to 1000 magnification. For this reason, it is noteworthy that this method can increase the certainty on identification of flora (Nakayama 2010). S. Nakayama defined this research method as the SEM method or Replica-SEM, and used it in the study of floral depressions on the pottery which made remarkable progress through the SEM observation (Nakayama 2007).

In this study, the object for observation is the carving mark of the seal, not depression on pottery. But the research method of the both cases is entirely same, so the author has used the term ‘SEM method’ in the present study.

I-B. Method for the SEM analysis

SEM analysis of Harappan seals is an underdeveloped study even today. For this reason, the process from making the replica to the SEM observation of the same, which is adapted in this study, refers to the method used for the SEM analysis of flora or seed depressions on the pottery (Nakayama 2010 et al.), adapted by the present author to its present use. All of surface data including the carving marks etc. is completely

transcribed on the surface of seal's replicas, which are gained in the following process. Thus it is possible to observe the details of the manufacture techniques of the seals in a full sense through the SEM.

① Selecting the seal to make replicas

Firstly, the researcher should select the seal to make replicas by the naked eye or low magnifying power loupe. At that occasion it is important to confirm whether the seal will be damaged or not in the making of the replicas. In case that it is determined that the object will be damaged based on a the deterioration or condition of the seal, the researcher must abandon the process to avoid damaging the seal. But in case that the main aim is to observe the manufacture techniques, it is not necessary to make the replica of the whole seal. Therefore, it is an effective practice that the researcher first selects the specific part by the naked eye or a low-powered lens, and then makes the replica of that part only.

② Cleaning of the object

After washing with water and brush, in many cases a foreign body such as mud collects into a depression as a false manufacture mark. Thus the researcher should clean the object carefully with a bamboo skewer to remove all foreign bodies. In that occasion the researcher needs to pay attention not to cause damage to the seal, because the raw material of the seal is steatite which is extremely soft. If the seal is well preserved, an ultrasonic cleaning machine can be effective in cleaning the same.

③ Taking photographs of the object and making a drawing of it to make a basic data

The researcher has to take photographs of the object and make drawing of it to make a basic reference data.

④ Filling of silicon resin

According to the kind of silicon resin used, there are two following methods ⁽³⁾.

(1) In case of using Toshiba silicon (TSE350) or 3M expressTM Light body Regular

type Hydrophilic Vinyl Polysiloxane Impression Material (green color 50ml: Catalyst, Base) for the dental medical treatment, which is used together with the Dispenser by GarantTM and Mixing tips (for yellow washing): If the researcher applies these types of silicon resin directly into the depression of the object, there is a danger that silicon resin will sink into the pores of the raw material and stick to the surface of the object at the time of hardening, resulting in the surface of the seal breaking. For this reason, it is necessary to apply the mold releasing agent to the surface of the object for protection beforehand. Concerning the mold releasing agent, the researcher first dissolved paraloid B-72, an acrylic resin, into acetone as an organic solvent at the ratio of 5 to 10%. This solution was then used as the mold releasing agent. The mold releasing agent should be applied thinly on the surface of the seal by brush. It is enough to cover the surface thinly, because if the researcher applies the mold releasing agent too thickly, it will be a serious hindrance to make the replicas of the seal. In that occasion, the researcher should pay attention that the applied solvent will form a flat layer on the surface of the seal by using the blower for photography.

(2) In case of using Nissin JM silicon (Regular type Hydrophilic Vinyl Polysiloxane Impression Material, blue color 74ml: Catalyst, Base) for the dental medical treatment, which is used in this study: In this case there is no need to use the mold releasing agent, it is enough to moisten the surface of the object with water just before the filling of silicon resin ⁽⁴⁾. In that occasion, the researcher should apply water to the surface of the seal by kimwiper (wiper S-200), which does not disintegrate into powder or strands in comparison with other paper tissues, and ensures that no foreign body is able to adulterate into the replica. In the following part, the author only describes the process recorded as method (2), which is used in the present study.

Next, the researcher does the first filling of the silicon resin. The impression paste will be hardened after mixing the Catalyst and Base equally. First the researcher must press out equal amounts of Catalyst and Base from the tubes on the paper having

a scale, and then mix both pastes with a plastic spatula to make the silicon resin. The researcher can decide the amount of the pastes to be used in accordance with the size of the object based on empirical knowledge. Due to the rapid hardening of the silicon, the researcher must work quickly and complete the operation in about 30 seconds for mixing both pastes- However; one must pay attention that air bubbles do not intrude into the silicon resin.

In the next step, the researcher applies water to the surface of the seal by the kimwiper and then fills up the prepared silicon resin into the depression by a plastic spatula. However, if the researcher fills up the silicon resin into the depression in one go, it will be a serious hindrance to the SEM observation because air bubbles will intrude into the replica. So, in order not to get bubbles into the replica and the silicon resin in the depression, it is best that the silicon resin should be filled little by little into the depression in as a small quantity as possible in the beginning. After completing the filing, it is desirable that some remaining silicon resin should be piled up on the replica to give strength to it.

It is necessary that the researcher should be fast in completing the process described above because the time to spare for operating of Nissin JM silicon is 2 minutes and 10 seconds. It is necessary to confirm experimentally the time needed for the hardening of JM silicon before the first filling of the silicon resin, because the time to spare for operating is affected considerably by the humidity and the temperature. The time taken by the silicon to harden will grow shorter than 2 minutes and 10 seconds under high humidity and temperature. Based on the experience of the author, it is a best to refrigerate the tubes of catalyst and base prior to use- this ensures that the resin takes more time to harden than it would at room temperature. Even under the high humidity and temperature, if the Catalyst and Base are sufficiently cold, the hardening of JM silicon will need about 30 to 40 seconds more in comparison to room temperatures. In some cases retarder may be used for delaying the hardening of the silicon. The retarder

also works effectively while cold.

⑤ Separating the replica from the object

Nissin JM silicon becomes hard for about 3 minutes from the beginning of the operation. After hardening, the researcher removes the replica from the seal, and then transcribing of the surface data of the seal is completely finished. During this operation, the researcher should do the operation carefully no to be broken the object.

⑥ Deposition of the replica for observation through SEM

If the object for the SEM observation does not have electric conduction, namely the silicon, it will be a serious hindrance to observe the replica, because the electric beam is irradiated to the object during observation by the scanning electric microscope. For this reason, the researcher should coat the replica by a carbon or a noble metal before the observation. In this study, gold dust was used for the coating of the replica.

⑦ Observation of the object through SEM

After the operations mentioned above, the researcher can observe the surface of the replica through the SEM (this study was done with the NIKKON Quanta 600). We can observe the object clearly in approximately 15 to 1000 magnification through the SEM as compared with the optical stereoscopic microscope, which has approximately 10 to 100 magnifying power. The optical stereoscopic microscope is difficult to focus onto objects that have uneven surface features, because the depth of focus of Optical stereoscopic microscopes is low. On the other hand we can get the clear image through the SEM because its depth of focus is quite deep.

3-II. 3D (PEAKIT) analysis

II-A. 3D (PEAKIT) analysis

The technology for the three dimensional analysis, which is used in this study, is a government approved technology ‘PEAKIT’ by a joint-stock corporation ‘Laboratory for Archaeology and Geoinformatics (Morioka/Japan)’. The PEAKIT is an image processing technology for extracting shape characteristic line from the 3D data of the

object clearly. In some cases other analytical images such as a shade image or color-layer image are superimposed onto the image of shape characteristic line of the object to get a more detailed image. They are generally called as PEAKIT (Chiba & Yokoyama 2009).

II-B. Method for the analysis

The 3D images (Figures 6.4, 6.5, 6.12, 6.16, 6.17, 6.27, 6.31, 6.35, 6.39, 6.45, 6.48, 6.49, 6.55, 6.57, 6.58, 6.65, 6.69, 6.73, 6.74, 6.75, 6.79, 6.85, 6.91 and 6.93) are PEAKIT images. These images are made by measuring the silicon replica, which is the same as the one used in the SEM analysis, in 0.05mm pitch. The PEAKIT images are color-layered images which place on the emphasis on a gully line. As is clear in these images, based on the PEAKIT images, it is possible to grasp the data of the surface of the Harappan seal visually. Such data is difficult to read by the photograph and the 3D relief image as imaginary shade. Furthermore according to the PEAKIT images, we can make the section image of the surface of the seal easily and get information of the shape and the depth of the carving mark, which is not possible by the SEM image.

4. The analyses based on SEM and 3D (PEAKIT) images of the seals in the Pre-/Early Harappan period and Harappan seals

4-I. Classification of the carving marks of the seals

The carving marks of the surface of the seal could be classified into the following (a), (b), (c) and (d) by the naked eye to discuss about the details of the carving tools, techniques and behavior in each manufacture process. The standard of the classification, namely (a), (b), (c) and (d), is common in the fired steatite seals of the Pre-/Early Harappan period and the Mature Harappan period.

(a) The carving marks derived from the carving behavior toward the face of steatite at right angles: carving marks derived from the carving of the body of animal, which is depicted on the surface,

- (b) The marks derived from the process for smoothing the carving mark (a): marks derived from the process for carefully forming the body of the animal motif depicted on the surface,
- (c) The carving marks derived from the process used to carve the line toward the face of steatite horizontally: carving marks derived from the carving straight or curve lines, which are part of Indus script or the horn, folds and legs of the animal motif,
- (d) The carving marks derived from the carving or boring, which are based on the rotational motion: carving marks derived from the carving or boring process used to carve the eye of the animal motif or concentric circles and to bore the boss.

In the following part, The author will observe the details of the carving marks (a), (b), (c) and (d) in a full sense through the SEM and PEAKIT and then discuss the carving techniques of the fired steatite seals of the Pre-/Early Harappan period and the Mature Harappan period. But before discussing, it is necessary to give a notice that the present interpretations of the carving marks in this study are tentative ones, which refer to the results of the SEM analysis and the experimental archaeology on the study of the seals in ancient Western Asia (Gwinnett & Gorelick 1979, 1987; Sax & Meeks 1994, 1995; Sax et al. 1998, 2000; Kiuchi 2005; Sudo 2012, etc.), because the experimental archaeology about the fired steatite seals of the Pre-/Early Harappan period and the Mature Harappan period is an important subject for future study.

It is also important to pay attention that the carving mark is observed as a convex, originally as a depression, and as a reversed image because the SEM and PEAKIT images are made from the replica of the seals. Furthermore some depressions in the SEM images and some blank spaces in the PEAKIT images are caused by the bubbles which get in the replica.











Carving mark (Shallow) ~0.633mm	A (V-shaped) 	B (U-shaped) 	Marks A and B are observed at the following parts:	Figure 6.1a for serial Nos. 1, 3 and 4 in Table 6.1 Figure 6.1b for serial No. 2 in Table 6.1
Carving mark (Deep) 0.633mm~			horn, neck, leg, tail, straight and curved line of geometric motif, etc.	
Carving mark (Shallow) ~0.637mm	A (V-shaped) 	B (U-shaped) 	Marks A and B are observed at the following parts:	6.1a
Carving mark (Deep) 0.637mm~			curved line of concentric circles	
Carving mark (Shallow) ~0.733mm	C 		Mark C is observed at the following parts:	6.1b
Carving mark (Deep) 0.733mm~			curved line of concentric circles	

Figure 6.1: Classification of the carving marks of seals in the Pre-/Early Harappan period

4-II. The analyses based on SEM and 3D (PEAKIT) images of the seals in the Pre-/Early Harappan period

II-A. Classification of the shape and depth of carving marks and sections

The author made PEAKIT images of three fired steatite seals from Kunal and classified the shape and depth of carving marks and sections, furthermore measuring the depth of carving marks and sections in order to discuss them in a full sense. The measurement of the surface of the seal is done in 5mm intervals. After enlarging the images the author measured all the parts, which are possible to measure, and calculated a mean value of the same (Table 6.1). According to the behavior of carving, although the depth of the carving points of the beginning and the end tend to be excessively shallow in comparison to other parts, in this study it was judged by the author that those points do not affect a mean value of them and calculated it with those data because there are only a few examples, where it is possible to measure the depth of the carving points of the beginning and the end. The classification of ‘deep’ and ‘shallow’ is based on the fact that the depth of the carving is more than the mean value or is lower than it. Although the samples for this study are only three, the author will describe the results of the observation in the following part.

Based on the PEAKIT images, we can understand that the sections of the carving

mark (c) are different in each part, and as is shown in Figure 6.1a, it was possible to classify the sections into those described below 0.633mm, as A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.633mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep).

Concerning the depth of the carving, they are different in each part. The depth of the carving marks of neck or legs of the animal motif is deep when compared with other parts. In many cases, we can observe the above 0.633mm sections A or B. There is a point of the leg which is measured at 1.27mm.

The deepest point of the carving is observed in the carving marks (a) and (b), namely the body part of the animal motif, and the section of the animal's body of a Kunal seal is formed in a squarish (Figures 6.3 and 6.4) section. The base of the body part is refined and smoothened to make a squarish section. Therefore the depth of the carving of that part is deeper than other parts (Table 6.1). The deepest point is measured as 1.331mm. It can be presumed that the body part is first carved roughly and then further refined by repeated back and forth or left and right strokes. For this reason, it is most likely that the depth of carving is in proportion to the frequency of the strokes.

Based on the PEAKIT images, we can understand that the sections of the carving mark (d) are different in each part, and as is shown in Figure 6.1b, their sections could be classified into the below 0.637mm sections A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.637mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep) and below 0.733mm sections C (shallow) or above 0.733mm sections C (deep). The width of the base of section C is wider and the depth of it is deeper than those of sections A and B. It is most likely that this feature is derived from the frequency of the rotating motion for the carving.

II-B. SEM analysis

In this part, the results of the SEM observations about the carving marks (a), (b), (c) and (d) are summarized and the details of the carving techniques of the fired steatite

seals in the Pre-/Early Harappan period are discussed.

i) Carving marks (a) and (b)

The carving marks are derived from the carving and forming process of the body (Figures 6.8 and 6.9: 2-f and 2-g) and the head (Figures 6.7 and 6.8: 2-b and 2-c) of the animal motif. Based on the SEM images, it is presumed that the body and the head parts are first carved roughly and then finalized by the bronze or copper tool with a flat head to make the base even. As a result of those carving and forming processes, the sections of the body and the head are shown in a squarish (Figures 6.7, 6.8 and 6.9: 2-b and 2-f) shape.

ii) Carving mark (c)

The carving marks are derived from the carving processes for making straight or curved lines. There are the curved lines that are forming the horns (Figure 6.7: 2-a and 2-b) and the head (Figure 6.8: 2-c), and the straight lines, which are forming the necks (Figure 6.8: 2-d and 2-e), the legs (Figures 6.9 to 6.11: 2-h, 2-I, 2-j and 2-k) and geometrical motifs (Figures 6.13 to 6.15 and 6.17 to 6.19). The straight and curved lines basically have section A or section B as the carving mark and small fine horizontal marks, which are observed at the sides of the carving marks. According to the marks, it is presumed that the straight and curved lines are basically carved by the back and forth or left and right strokes by using the bronze or copper tool with a pointed head.

iii) Carving mark (d)

The carving marks are derived from the carving process for making a group of concentric circles (Figures 6.5 and 6.6: 1-a to d). The carving marks basically have section A, section B or section C and small fine horizontal marks, which are observed at the sides of the carving marks. The joining point for the carving is not observed in each concentric circle, so the using of the bronze or copper pipe-shaped tool is assumed. It is presumed that the section C is derived from the rotation with that tool. Based on the small fine horizontal marks, which are observed at the sides of the carving marks of

each concentric circle, the drilling technique by the rotation motion is assumed (Figure 6.6-1a).

II-C. Short summary

Based on the PEAKIT images, we can understand that the sections and the depth of the carving mark (c) are different in each part, and their sections can be classified into the below 0.633mm sections A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.633mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep) (Figure 6.1a). The deepest point of the carving is observed in the carving marks (a) and (b), namely the body part of the animal motif, and the section of the animal's body of a Kunal seal is formed in a squarish cross section (Figures 6.3 and 6.4). Concerning the sections and the depth of the carving mark (d), they are also different in each part, and as is showed in Figure 6.1b, their sections could be classified into the below 0.637mm sections A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.637mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep) and below 0.733mm sections C (shallow) or above 0.733mm sections C (deep).

Based on the SEM images, it can be pointed out that the small fine horizontal marks are observed at the sides of the carving marks (c) and (d), and the tools for carving include the bronze or copper ones which have a below 1.0mm (in some case below 0.5mm) width and a flat, pointed or pipe-shaped head.

Based on these results of the observations though the SEM and the 3D (PEAKIT), it is presumed that the seal makers first fix the steatite block firmly and carve the outline of the motifs in rough, then form each part of the motif carefully and skillfully by repeating the back and forth or left and right strokes, up-and-down strokes or strokes based on the rotating motion by using various tools mentioned above. In this study even the maximum diameter of the largest seal is measured at about 28.5mm. According to their delicate carving techniques, it is most likely that the techniques of the seal makers are based on a wealth of experience and special knowledge and training.









Carving mark (Shallow) ~0.728mm	A (V-shaped) 	B (U-shaped) 	Marks A and B are observed at the following parts:	Carving mark (Shallow) ~1.056mm	C 	D 	Marks C and D are observed at the following parts:
Carving mark (Deep) 0.728mm~			Indus script, horn, neck, fold, leg, tail, staff, straight and curved line of geometric motif, etc.	Carving mark (Deep) 1.056mm~			a part which is carved in several times such as leg (thigh), tail, etc.

Figure 6.2: Classification of the carving marks of Harappan seals

4-III. The analyses based on SEM and 3D (PEAKIT) images of the Harappan seals

III-A. Classification of the shape and depth of carving marks and sections


















The author made the PEAKIT images of 20 fired steatite Harappan seals, which are mentioned above, and classified the shape and depth of the carving marks and the sections, and measured the depth of carving marks and sections to discuss about them in a full sense. The measurement of the surface of the seal is done in 5mm intervals. After enlarging the images the author measured all of parts which could be measured, and calculated a mean value of the same (Table 6.1). As mentioned above, according to the process of carving, although the depth of the carving points of the beginning and the end tend to be excessively shallow in comparison with other parts, in this study it was judged that those points do not affect a mean value of the same and the author calculated it along with those data because there are only a few examples, which are possible to measure the depth of the carving points of the beginning and the end. The classification of ‘deep’ and ‘shallow’ is based on the fact that the depth of the carving is more than a mean value or lower than it.

Based on the PEAKIT images, it is presumed that the sections of the carving mark (c) are different in each part, and as is showed in Figure 6.2, their sections could be classified into the below 0.728mm sections A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.728mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep) and the below 1.056mm sections C (shallow) or D (shallow) and the above 1.056mm sections C (deep) or D (deep). The base of sections C and D is wider

and its depth is greater than those of sections A and B. It is presumed that this feature is derived from the frequency of the carving strokes.

Concerning the depth of the carving, they are different in each part. The depth of the carving marks of Indus script and horn or neck of the animal motif is deep in comparison with other parts. In many cases, the above 0.728mm or 1.056mm sections A, B, C and D are observed. In case of the largest example from Mohenjodaro (Figure 6.79), the average depth of the sections A and B are measured in 1.079mm and the sections C and D are measured in 1.3mm. On the other hand in case of the smallest example from Banawali (Figure 6.55, see also Figure 1.3-4), the average depth of the sections A and B are measured in 0.385mm and the sections C and D cannot be observed. According to this observation, it is presumed that the depth of the carving is related to the size of the seal. Concerning the average of the depth of the carving marks in each site, in Farmana the sections A and B are measured in 0.638mm and the sections C and D are measured in 0.972mm, in Banawali the sections A and B are measured in 0.588mm and the sections C and D are measured in 0.827mm, in Mohenjodaro the sections A and B are measured in 0.904mm and the sections C and D are measured in 1.377mm. Although the samples are few in number, in connection with this point, it may be noted here that this result shows the difference of the depth of the carvings in each site or region.

The deepest point of the carving is observed in the carving marks (a) and (b), namely the body part of the animal motif, and the sections of the animal's bodies of the Harappan seal could be classified into a concave, squarish or a concave-squarish section, which shows the middle shape of both (Figures 6.3). The base of the body part is formed smoothly to make a concave, a squarish section or a concave-squarish section. So the depth of the carving of those parts is deeper than other parts (Table 6.1). In this study, these sections of the animal's body are referred to as 'concave section (Figure 6.3-5 to 11)', 'squarish section (Figure 6.3-15 to 22)' or 'concave-squarish section

Concave							Concave-squarish		Squarish									
																		
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
L	L	L	L	L	L	L	R	R	R	L	R	R	R	R	R	R	R	3
Mean value of the depth=2.312mm										Mean value of the depth=1.331mm								
① body part of the animal motif is engraved roughly, ② a rough engraved part is refined to make a concave section.							formed marks are similar to them of a squarish section.		① body part of the animal motif is engraved roughly, ② a rough engraved part is refined to make a squarish section.									

* Sections in Figure 6.3 are displayed in 200%. * Numbers of each section correspond with the serial number in Table 6.1 and L or R at the lower part of each number mean the direction of the head of animal motif.

Figure 6.3: Classification of the sections of the body of the animal motifs

(Figure 6.3-13, 14)' respectively. The average depth of the concave section is measured in 2.312mm and the squarish section is measured in 1.331mm. It is presumed that the body part is first carved roughly and then formed by the back and forth or left and right strokes, which are done repeatedly. For this reason, it can be pointed out that the depth of carving is in proportion to the frequency of the strokes. Furthermore, as is shown in Figure 6.3, the concave section basically corresponds to the Harappan seals having a left-facing animal, on the other hand the squarish section basically corresponds to the Harappan seals having a right-facing animal. Concerning the site from where the seals came, the squarish section is characteristic of the Ghaggar Basin.

The seal having a geometrical pattern as a main motif (Figure 6.74, see also Figure 1.3-7) has only the sections A and B as the carving mark (c) and the average

of their depth is measured in 0.971mm (a certain part is measured in 1.25mm). And a convex type Harappan seal (Figure 6.75, see also Figure 4.3) has only sections A and B as the carving mark (c) and the average of their depth is measured in 1.061mm (a certain part is measured in 1.55mm).

III-B. SEM analysis

In this part, the author sums up the results of the SEM observation about the carving marks (a), (b), (c) and (d) or sections of them A, B, C and D and discuss the details of the carving techniques of the fired steatite seals in the Harappan period. In this study, the author focuses on the difference of the carving marks and techniques between the Harappan seals having a left-facing animal (i.e. Type A seals) and the Harappan seals having a right-facing animal (i.e. Type B seals), to discuss the regional variations of the Harappan seals, which is mentioned in the Chapter 5, in more detail.

i) Carving marks (a) and (b)

The carving marks are derived from the carving and forming process of the body of the animal motif. As is confirmed in the PEAKIT images, based on the SEM images, it can be pointed out that the sections of the body of the animal motifs are showed in a concave section, a squarish section or a concave-squarish section.

Concerning the concave sections of the body of the animal motif, it is presumed that they are first carved roughly and then refined to make a concave shape (Figures 6.25, 6.29, 6.30, 6.34, 6.46, 6.47, 6.88, 6.89 and 6.93: 5-j, 6-e, 7-g, 10-d, 20-j, 20-l and 22-i). According to the observations of the small fine marks (Figures 6.25, 6.88, 6.89 and 6.97: 5-j, 20-j, 20-l and 22-i), which are observed at the bottom of the section of the body, it can be pointed out that the seal makers carefully repeated the carving behavior, which is based on the back and forth or left and right strokes by using the bronze or copper tool with a pointed head etc., many times to make the section concave.

Concerning the squarish sections of the body, it is presumed that they are first carved roughly and then the base of the section of the body is formed in a plane to

make a concave shape at the final step by using the bronze or copper tool with a flat head (Figures 6.37, 6.38, 6.43, 6.54, 6.56, 6.59, 6.60, 6.62, 6.63, 6.64, 6.67, 6.68, 6.71, 6.72, 6.82 and 6.83: 8-f, 9-m, 12-e, 13-c, 14-e, 15-c, 16-g, 17-f, and 19-k). The small fine marks (Figures 6.43, 6.54 and 6.68: 9-m, 12-e and 16g), which could be derived from the using of the bronze or copper tool with a flat head, are clearly observed at the bottom of the section of the body. According to the SEM images, we can understand that the bronze or copper tool with a flat head for forming the section a squarish include the one having a flat head which is measured about 0.5mm in width.

Concerning concave-squarish section, based on the SEM images, it is an important feature that the carving marks to make a concave-squarish section are similar to those of the squarish section. As well as the carving marks which are observed in the squarish sections, it can be pointed out that they are the carving marks derived from the bronze or copper tool with a flat head which is measured about 0.5mm in width (Figures 6.63 and 6.83: 15-c and 19-k).

According to the results of the SEM analysis in this chapter, it is presumed that the differences of the section of the animal's body, namely a concave section, a squarish section or a concave-squarish section, reflect the differences of the carving technique and tool which are used in the final forming process. And it may be reiterated here that the concave section basically corresponds to the Harappan seals having a left-facing animal, on the other hand the squarish section basically corresponds to the Harappan seals having a right-facing animal (Figure 6.3). Furthermore the squarish section is characteristic in the Ghaggar Basin.

Concerning a Harappan seal having a right-facing horned tiger motif, the original shape of the section of the body cannot be observed because all of the body is filled up by many folds due to the unique carving of the tiger's striped pattern (c) (Figure 6.51: 11-k).

ii) Carving mark (c)

The carving marks are derived from the carving behavior for making straight or curved lines.

They are confirmed at various parts such as Harappan script (Figures 6.22, 6.23, 6.28, 6.32, 6.33, 6.36, 6.40, 6.41, 6.49, 6.53, 6.58, 6.66, 6.70, 6.76 to 6.78, 6.80, 6.81, 6.86, 6.87, 6.92, 6.95 and 6.96: 5-a to e, 6-a and b, 7-a to c, 8-a and b, 9-a to f, 11-a to d, 12-a, 14-a, 16-a to c, 17-a, 18-a to f, 19-a to d, 20-a to e, 21-a and b and 22-a to c), the horn of the animal motif (Figures 6.23, 6.28, 6.29, 6.33, 6.36, 6.37, 6.41, 6.46, 6.50, 6.53, 6.56, 6.58, 6.59 6.70, 6.81 and 6.87: 5-g, 6-c, 7-d and e, 8-c, 9-g and h, 10-a, 11-e, 12-b, 13-a and b, 14-b and d, 17-b and c, 19-e and 20-f), the head of the animal motif (Figures 6.23, 6.29, 6.37, 6.42, 6.46, 6.50, 6.53, 6.56, 6.59, 6.62, 6.66, 6.67, 6.70, 6.71, 6.81, 6.88, 6.92 and 6.96: 5-f, 6-d, 8-c and d, 9-i, 10-b, 11-f and g, 12-b and c, 13-a, 14-c, 15-a, 16-d and e, 17-e, 19-f, g and h, 20-g and I, 21-c), the fold of the animal motif (Figures 6.23, 6.24, 6.33, 6.37, 6.43, 6.46, 6.50, 6.51, 6.53, 6.82, 6.92 and 6.96: 5-h and i, 7-f, 8-e, 9-k and I, 10-c, 11-h to n, 12-d, 16-e, 17-i and j, 19-I and j, 21-c, 22-d and f) and the breast of the animal motif (Figures 6.26, 6.30, 6.34, 6.38, 6.43, 6.44, 6.47, 6.51, 6.54, 6.60, 6.64, 6.68, 6.72, 6.83, 6.90, 6.93 and 6.98: 5-k, 6-f to h, 7-h and i, 8-g and h, 9-n to r, 10-e and f, 11-n, 12-f and g, 14-f to h, 15-d to g, 16-h to j, 17-g and h, 19-l to m, 20-o, 21-e and f and 22-j to m). The straight and curved lines basically have section A or section B as the carving mark (c) and the small fine horizontal marks, which are observed at the sides of the carving marks. According to the marks, it is presumed that the straight and curved lines are basically carved by the back and forth or left and right strokes by using the bronze or copper tool with a pointed head.

The vertical carving marks are confirmed on the small fine horizontal carving marks at the specific parts of the horn (Figures 6.41 and 6.70: 9-h and 17-c), the head (Figure 6.23: 5-g) and the fold (Figures 6.24 and 6.90: 5-i, 20-m and n). These parts are characterized in the sharp curved line. For this reason, in case of giving emphasis

on the curved line, it is presumed that the seal maker carved in a vertical direction after carving by the back and forth or left and right strokes. Furthermore in case of carving a sharp curved line such as a horn (Figure 6.41: 9-g), we can observe a sharp curved line which consists of two strokes.

Concerning another specific carving technique, namely circular carving marks, is confirmed at the parts of Indus script (Figures 6.49, 6.66, 6.86 and 6.96: 11-b, 16-b, 20-b, 22-c) and the leg of the animal motif (Figures 6.64 and 6.68: 15-d and f, 16-h to j). With regard to the circular carving mark, it is presumed that the seal maker first started the carving by the back and forth or left and right strokes, and then move the tool in clockwise or counter-clockwise to carve a oval shape. This carving technique, which is especially observed at the leg part of the animal motif (Figures 6.64 and 6.68: 15-d and f, 16-h to j), it is characterized in the seals having an animal motif characterized by a squarish or a concave-squarish section.

iii) Carving mark (d)

The carving marks are derived from the carving process based on the rotation motion. They are observed at the parts such as Indus script (Figures 6.32: 7-a), dots in a line of the staff (Figures 6.47 and 6.84: 10-g, 19p and r), the eye of the animal motif (Figures 4.42, 6.50, 6.67, 6.81 and 6.96: 9-j, 11-g, 16-e, 17-d, 19-g and 22-e), the face (especially nose and mouth) of the animal motif (Figures 6.36, 6.62 and 6.71: 8-c, 15-a and b and 17-e), the toe of the animal motif (Figures 6.64 and 6.98: 15-e and 22-j to m) and the bored part of the boss (Figure 6.26). The continuous carving marks based on the rotation motion are observed especially at dots in the line of the staff (Figure 6.84: 19p and r) and the eye of the animal motif (Figures 6.42, 6.71 and 6.81: 9-j, 17-e and 19-g). According to these carving marks, it is presumed that they are based on the drilling technique by the bronze or copper tool with a globular-tip. Concerning the parts of Indus script (Figures 6.32: 7-a), the face (especially nose and mouse) of the animal motif (Figures 6.36, 6.62 and 6.71: 8-c, 15-a and b and 17-e) and the toe of the animal

motif (Figures 6.64 and 6.98: 15-e and 22-j to m), as is showed in the SEM images, they could also be carved by the drilling technique. And the continuous carving marks based on the rotation motion are observed at the bored part of the boss (Figure 6.26). It is presumed that this part is carved by the drilling technique with the bronze, copper or stone tool.

III-C. Short summary

Based on the PEAKIT images, we can understand that the sections and the depth of the carving mark (c) are different in each part, and their sections could be classified into the below 0.728mm sections A (i.e. V-shaped, shallow) or B (i.e. U-shaped, shallow) and the above 0.728mm sections A (i.e. V-shaped, deep) or B (i.e. U-shaped, deep) and the below 1.056mm sections C (shallow) or D (shallow) and the above 1.056mm sections C (deep) or D (deep) (Figure 6.2). The deepest point of the carving is observed in the carving marks (a) and (b), namely the body part of the animal motif, and the sections of the animal's body of the Harappan seals can be classified as concave, a squarish or a concave-squarish one (Figure 6.3).

Based on the SEM images, it can be pointed out that the small fine horizontal marks are observed at the sides of the carving marks (c) and the tools for carving include the bronze or copper tools which have a below 1.0mm (in some case below 0.5mm) width and a flat, pointed or globular head. And we can understand that the sections of the animal's body in the Harappan seals can be classified as concave, a squarish or a concave-squarish one through even the SEM images. As is indicated by this analysis, it is presumed that the concave section and the squarish section are based on the different carving techniques and tools (Figures 6.25, 6.43, 6.54, 6.68, 6.88, 6.89 and 6.97: 5-j, 9-m, 12-e, 16g, 20-j, 20-l and 22-i). Concerning the concave-squarish sections, it can be pointed out that they are formed by the bronze or copper tool with a flat head which is measured in below 0.5mm width (Figures 6.63 and 6.83: 15-c and 19-k) through the SEM images as well as the squarish section. Concerning the provenance

of these seals, the squarish section is characteristic in the Ghaggar Basin.

Based on the results of the observations through the SEM and the 3D (PEAKIT), it is presumed that the seal makers first fixed the steatite block firmly and carved the outline of the motifs roughly, then formed the each part of the motif carefully and skillfully by repeating the back and forth or left and right strokes, up-and-down strokes or strokes based on the rotation motion by using various tools and methods mentioned above. In this study even the largest seal is measured in about 30.0mm on one side. According to their delicate carving techniques, it can be pointed out here that the techniques of the seal makers are based on a wealth of experience and special knowledge and training.

5. Discussion

5-I. Sequence of the carving techniques of the seals in the Pre-/Early Harappan period and the Harappan seals

I-A. Seals in the Pre-/Early Harappan period and the Harappan seals

As observed in the SEM images, it can be pointed out that the clarity of the carving marks and the small fine horizontal marks which are observed at the sides of the same, the seals of the Pre-/Early Harappan period cannot be clearly compared with those of the Harappan seals. It is presumed that this feature is derived from the abrasion due to the continuous use of the seal, but it is not completely certain. Therefore in this study the author has positively evaluated the carving marks of the seals in the Pre-/Early Harappan period which are observed through the SEM.

Although the seals of the both periods have a lot of differences in terms of the design such as the motif of the surface, it is clear that they also have a lot of commonality as regards the carving marks and techniques. If the seal maker carves the same material, namely steatite, using the same tools, the marks left by the carving process will of course look similar. Based on the results of the present observations,

it can be pointed out that the seal makers of the both periods held the selection of the raw material and some aspects of the carving techniques in common. As the analyses describe, it is presumed that some aspects of the carving techniques of the seals in the Pre-/Early Harappan period gradually evolved into those of the Harappan seals.

On the other hand, there are certain differences between the two. The specific carving techniques of the Harappan seals (Figures 6.23, 6.41, 6.68 and 6.84: 5-g, 9-g, 16-j and 19r, etc.) can not be observed in the seals in the Pre-/Early Harappan period because the complex carving techniques are adopted in the Harappan seals, which have various motifs such as animals, Indus script and staff, are absent in the seals of the Pre-/Early Harappan period.

Furthermore, as far as the carving style of the animal's body of the both periods is concerned, the section of the animal's body in the Pre-/Early Harappan period is formed in a squarish shape. In connection with this point, it can be pointed out that this is common with the Harappan seals having a right-facing animal motif (i.e. Type B seal). As is confirmed in this study, the distribution area (i.e. the Ghaggar Basin) of these seals is also constant. Thus, it can be pointed out that some aspects of the carving techniques of the seals in the Pre-/Early Harappan period succeeded to the Harappan seals having a right-facing animal (i.e. Type B seal).

I-B. Harappan seals and the Convex type Harappan seal

As is confirmed in Chapter 1, the convex type seals having only Harappan scripts as a main motif (Figure 6.75, see also Figure 4.3) had been used in the later part of the Harappan phase. Although the sample for the observation in this study is only one, almost same carving techniques are observed between the convex type seal and the typical Harappan seals. As is indicated by the SEM, the small fine horizontal marks, which are observed at the sides of each carving marks, are also same. And the carving techniques of the convex type seal are not inferior to those of the Harappan seals. In connection with this point, it can be pointed out that the carving techniques of the

convex type seal are more sophisticated than those of the Harappan seals. It has only the sections A and B as the carving mark (c) and the depth is measured in 1.5mm at a point.

5-II. The difference of carving techniques among the Harappan seals

As far as the difference of the carving techniques among the Harappan seals is concerned, based on the SEM and PEAKIT images, it can be confirmed that there are differences on the carving marks (a) and (b). That is to say, their differences are reflected on the carving techniques and the tools to make the section of the animal's body concave, squarish or concave-squarish. It is estimated that the carving tool for making a squarish section is the bronze or copper tool with a flat head which is measured in below 0.5mm width. The tool is clearly different from the tool for making a concave section (Figures 6.25, 6.43, 6.54, 6.68, 6.88, 6.89 and 6.97: 5-j, 9-m, 12-e, 16g, 20-j, 20-l and 22-i). According to the observations through the SEM and the PEAKIT, it can be pointed out that the difference of sections of the animal's body, namely concave or squarish, shows the difference of the carving technique among the Harappan seals. Concerning the concave-squarish section, it is presumed that the carving marks of it are common with that of the squarish section.

As far as the carving mark (c) is concerned, through the SEM and the PEAKIT, the sections A, B, C and D are observed in the carving mark (c) and they basically have the same carving marks.

But a specific carving technique, where it is presumed that the seal maker started the carving by the back and forth or left and right stroke first and then moved the tool in clockwise or counter-clockwise to carve an oval shape (Figure 6.68: 16-j etc.), is characterized in the seals having a animal motif, with a squarish or a concave-squarish section.

6. Chapter conclusion

The SEM and 3D images show various evidences of manufacture techniques of the seals. As is indicated by the analysis in this chapter, it can be pointed out that a part of carving techniques of the Pre-/Early Harappan seals were passed on to those of Mature Harappan seals and almost the same carving techniques are observed between the convex type seal and the typical Harappan seals.

The shapes of section (i.e. a concave section, a squarish section or a concave-squarish section) and carving techniques of the body part of animal motifs, which are depicted on the seals, give an important clue to understand regional variation of the carving techniques among the Harappan seals. As a conclusion, it is worthwhile to note that the body of Type A seals which are characterized by left-facing animal motifs, basically have a concave section, while on the other hand, the body of Type B seals which are characterized by right-facing animal basically have a squarish section or a concave-squarish section. According to observations through the SEM and 3D images, it can be pointed out here that a concave section and a squarish section or a concave-squarish section of the body is based on the different manufacture techniques and the tools. And it may be possible that the different manufacture techniques and the tools of both section types are understood as the indicators towards understanding different manufacture areas of each type of seal.

Concerning the site which the seals came from, the seals having an animal motif which is characterized in a squarish section are characteristic to the Ghaggar Basin. In connection with this point, it can be pointed out that the distribution pattern of the seals characterized by a concave section and the seals characterized by a squarish section or a concave-squarish section is also different respectively ⁽⁵⁾.

In conclusion, the results of this chapter also lead to an important observation- that the seals having a right-facing animal and a squarish section or a concave-squarish section, namely Type B seals, are very likely to show the regional variation or diversity

of Harappan seals that has not been pointed out so far⁶.

Notes

- 1) The steatite (the Mohs hardness 1) gets a color reaction, from black to white, and changes to enstatite (the Mohs hardness 3.5) under the firing at around 1000°C . It can be presumed that the seal makers controlled the hardness of the steatite and improved the nature of the steatite, which tend to be cracked, and the durability though this heating technology.
- 2) There are useful studies for understanding the carving techniques and identifying the carving tools through the SEM analysis and the experimental archaeology on the study of the seals in ancient Western Asia (Gwinnett & Gorelick 1979, 1987; Sax & Meeks 1994, 1995; Sax et al. 1998, 2000; Kiuchi 2005; Sudo 2012, etc.). It is most likely that the same methods for the analyses will lead to success on the studies for understanding the carving techniques and identifying the carving tools of the Harappan seals.
- 3) In this study, the author used the Nissin JM silicon (Regular type Hydrophilic Vinyl Polysiloxane Impression Material, blue color 74ml: Catylst, Base) for the dental medical treatment to make replicas of the seals. Based on personal experience, this Nissin JM silicon is suitable for making replicas of the seals. But the author has just described a method for making replicas of the seals, which is adapted in practice. Experiments and further testing must be done for searching the best silicon to make replicas of the seals.
- 4) In principle, it is enough to moisten the surface of the object by water just before filling of silicon resin for protecting against the penetration by the oil contained in the silicon resin into the object. But even in this case it is a better way to protect the surface of the object by the mold releasing agent, which is dissolved paraloid B-72 as acrylic resin by acetone as organic solvent at the ratio of 5 to 10%.
- 5) Based on the classification in this study and the photographs of the seals in *the CISI*, it can be pointed out that the Harappan seals from Banawali (B-3, B-4, B-8, B-9 and B-12) and Kalibangan (K-6, K-16, K-17, K-18 and K-43) in *the CISI* are characterized in a squarish section of the animal motif's body. The Harappan seals from Bhirrana (Rao, L.S. et al. 2004: Pl. 3) also have the same feature.
- 6) Concerning the Harappan seals discovered outside of the Ghaggar Basin, namely a seal from Bala kot (Blk-5), the seals from Mohenjodaro (M-233, M-269, M-270, M-272, M-273, M-977 and M-1139), the seals from Harappa (H-73 and H-1688) and the seals from Dholavira (NHK • NHK promotion 2000), it can be noted that they are also characterized by a right-facing animal having a squarish section of the body respectively, like the Type B seals from the Ghaggar Basin. The Harappan seal from Bala kot (Blk-5), holds not only the same carving techniques but also a spear-like shaped Indus letter, that are characterized in the Type B seals from the Ghaggar Basin.



Altitude [mm]

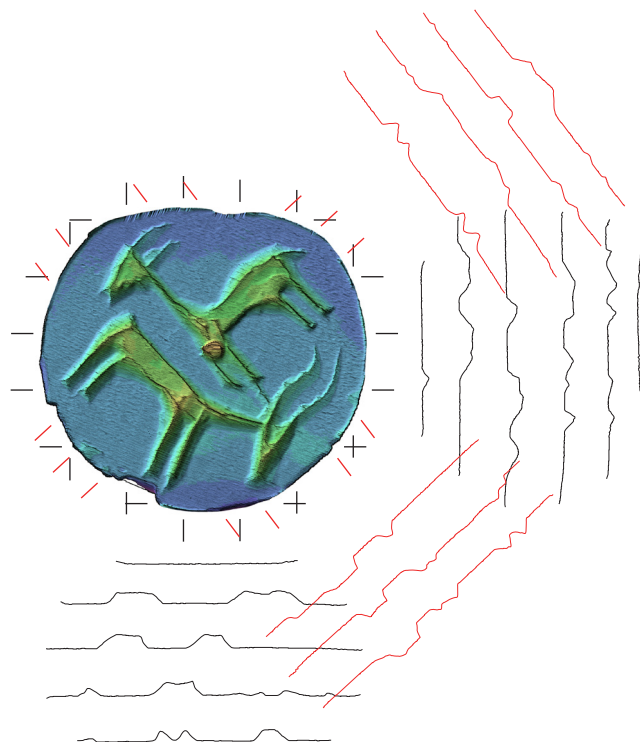
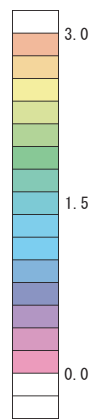


Figure 6.4: Photograph and PEAKIT image of seal discovered from the period IC(i) at Kunal (see also Figure 3.1-1)

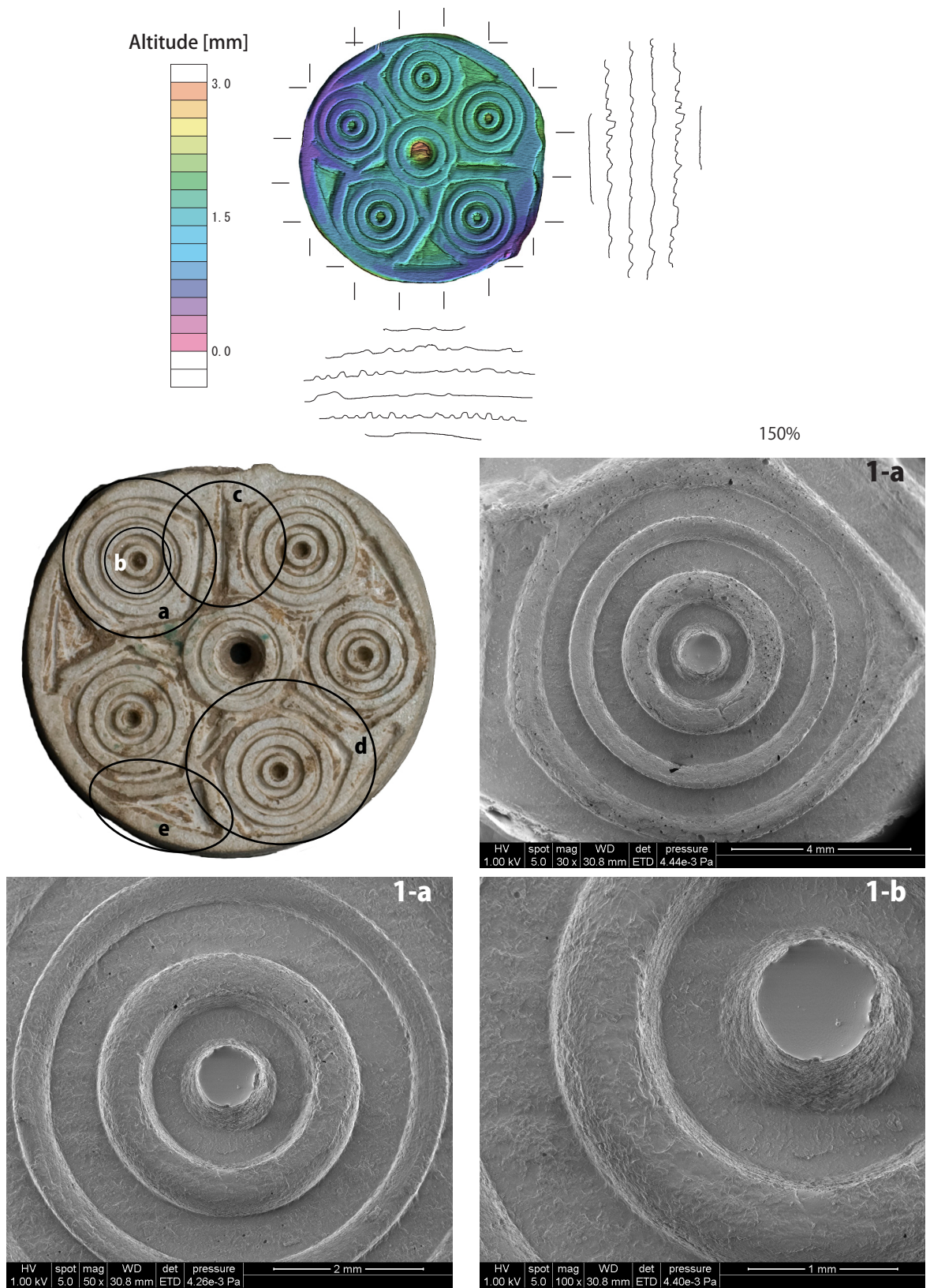


Figure 6.5: Photograph, PEAKIT and SEM images of seal discovered from the period IC(i) at Kunal (see also Figure 3.1-1)

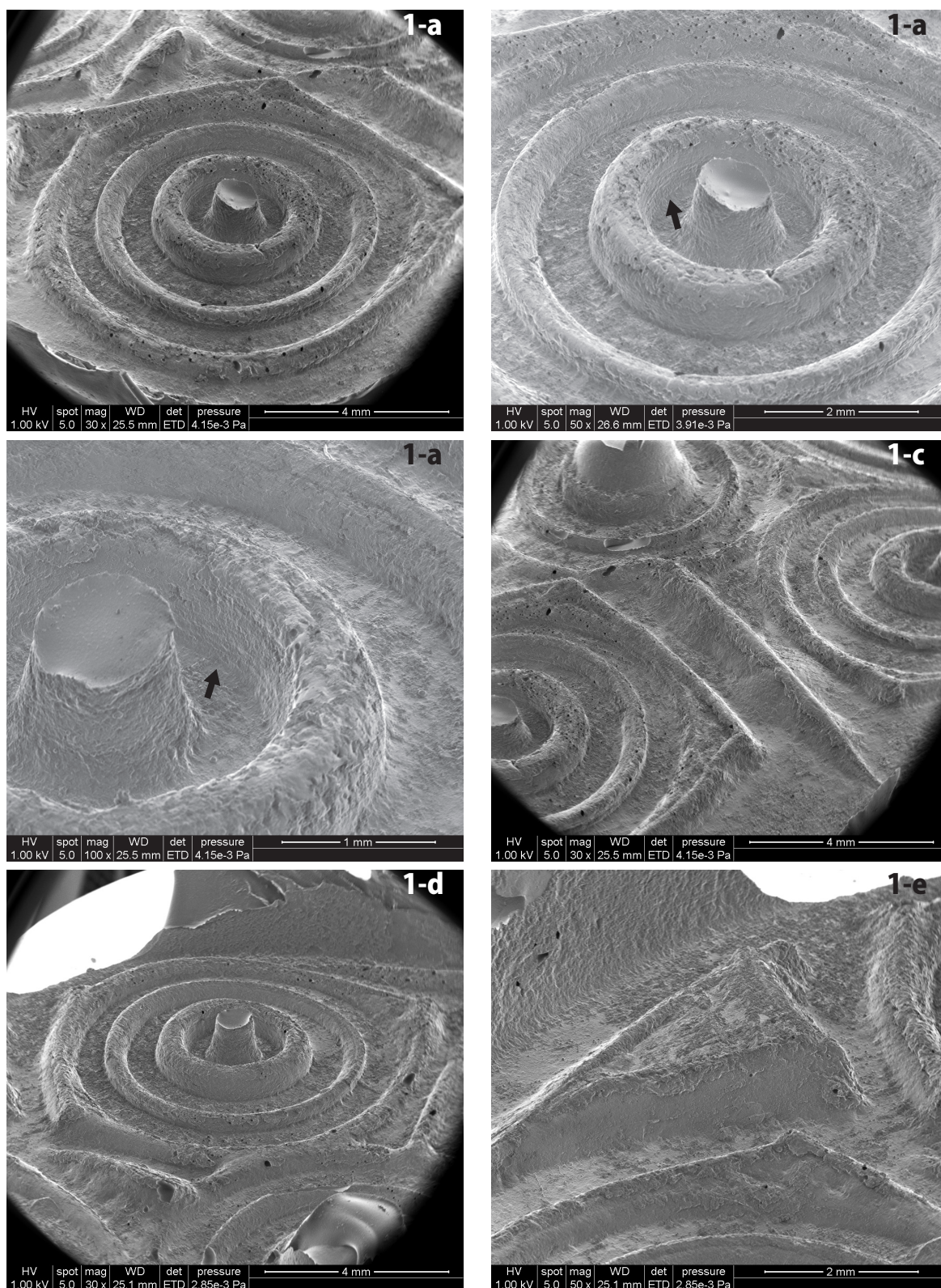


Figure 6.6: SEM images of seal discovered from the period IC(i) at Kunal

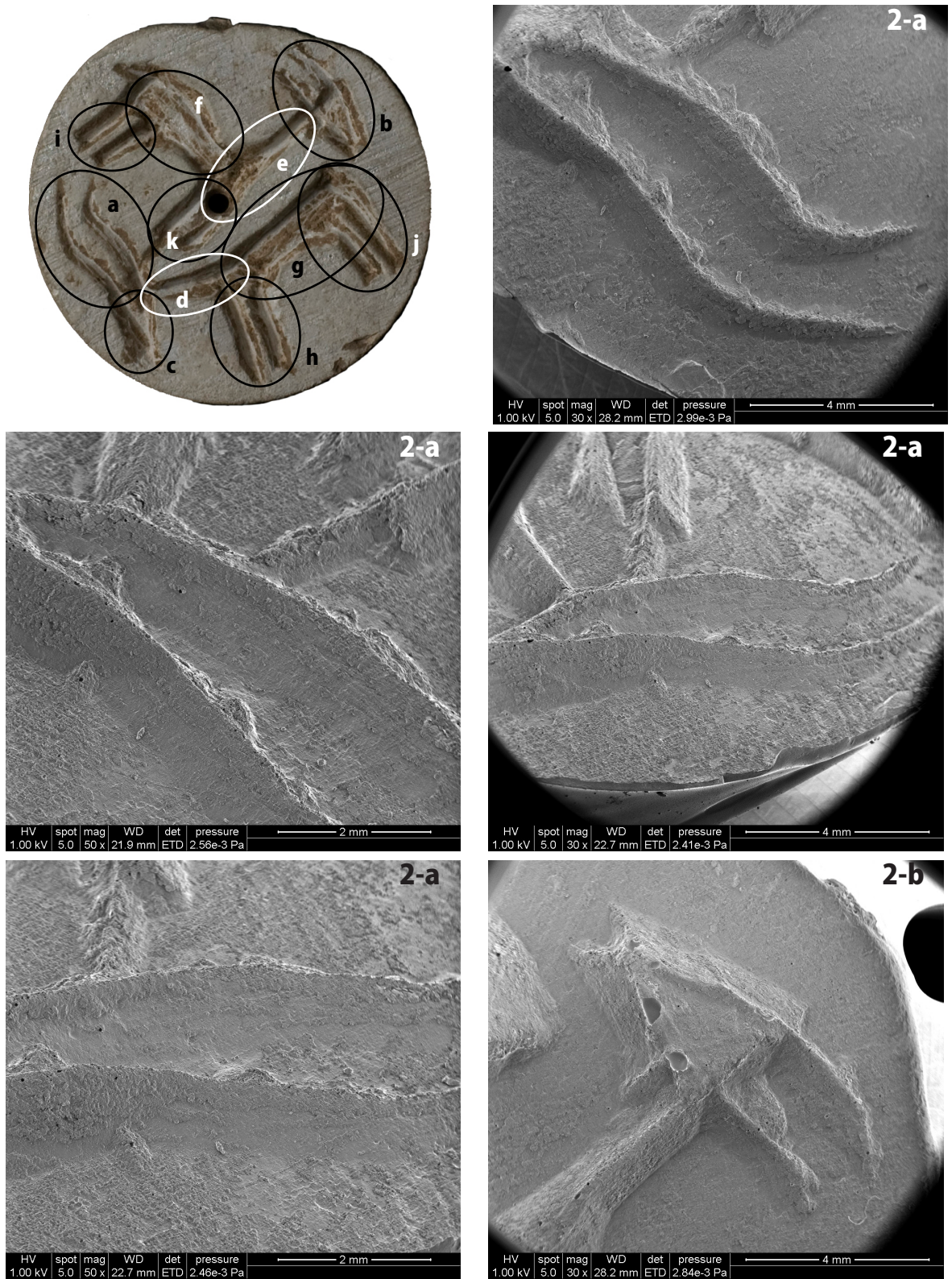


Figure 6.7: Photograph and SEM images of seal discovered from the period IC(i) at Kunal (see also Figure 3.1-1)

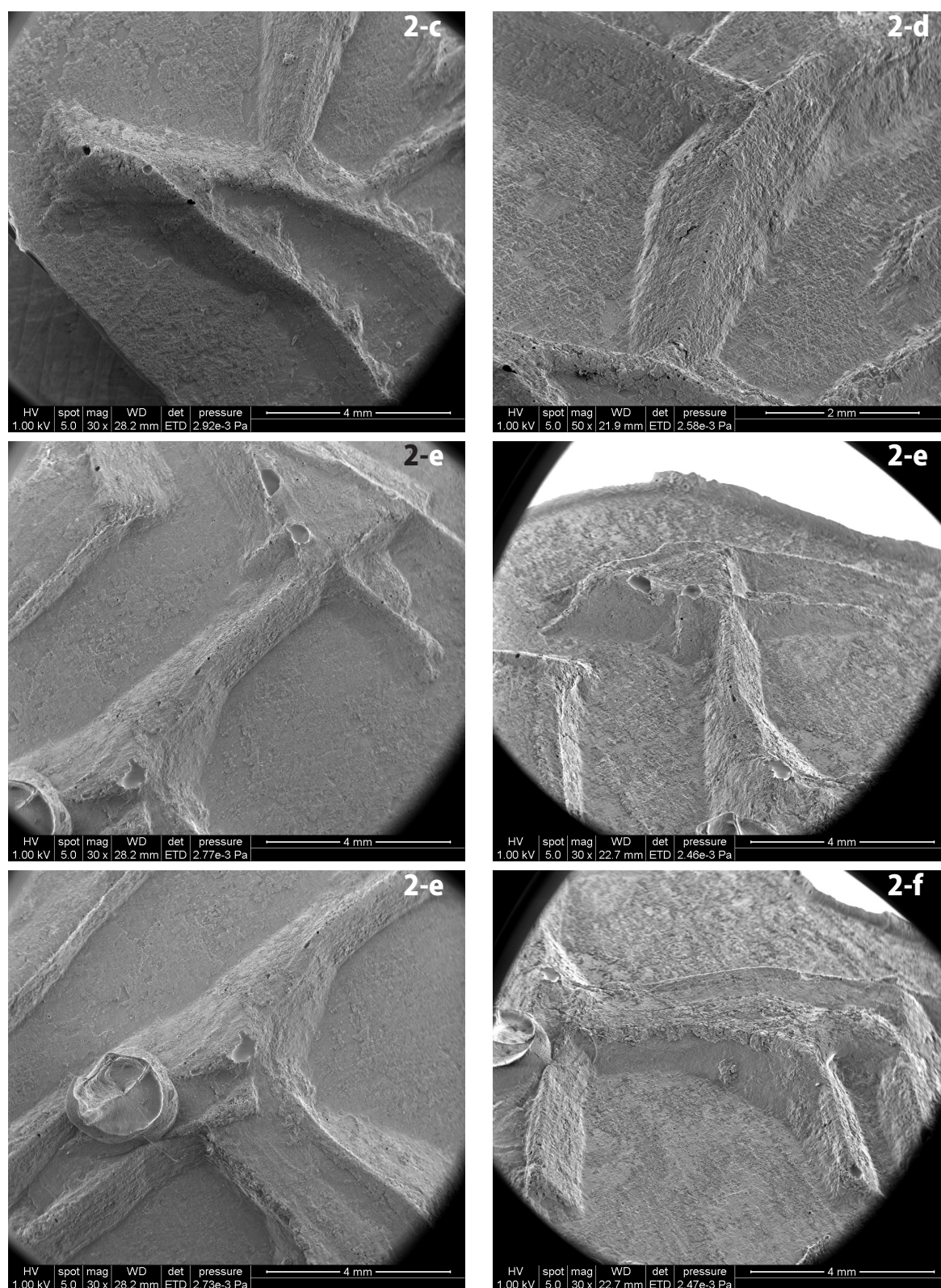


Figure 6.8: SEM images of seal discovered from the period IC(i) at Kunal

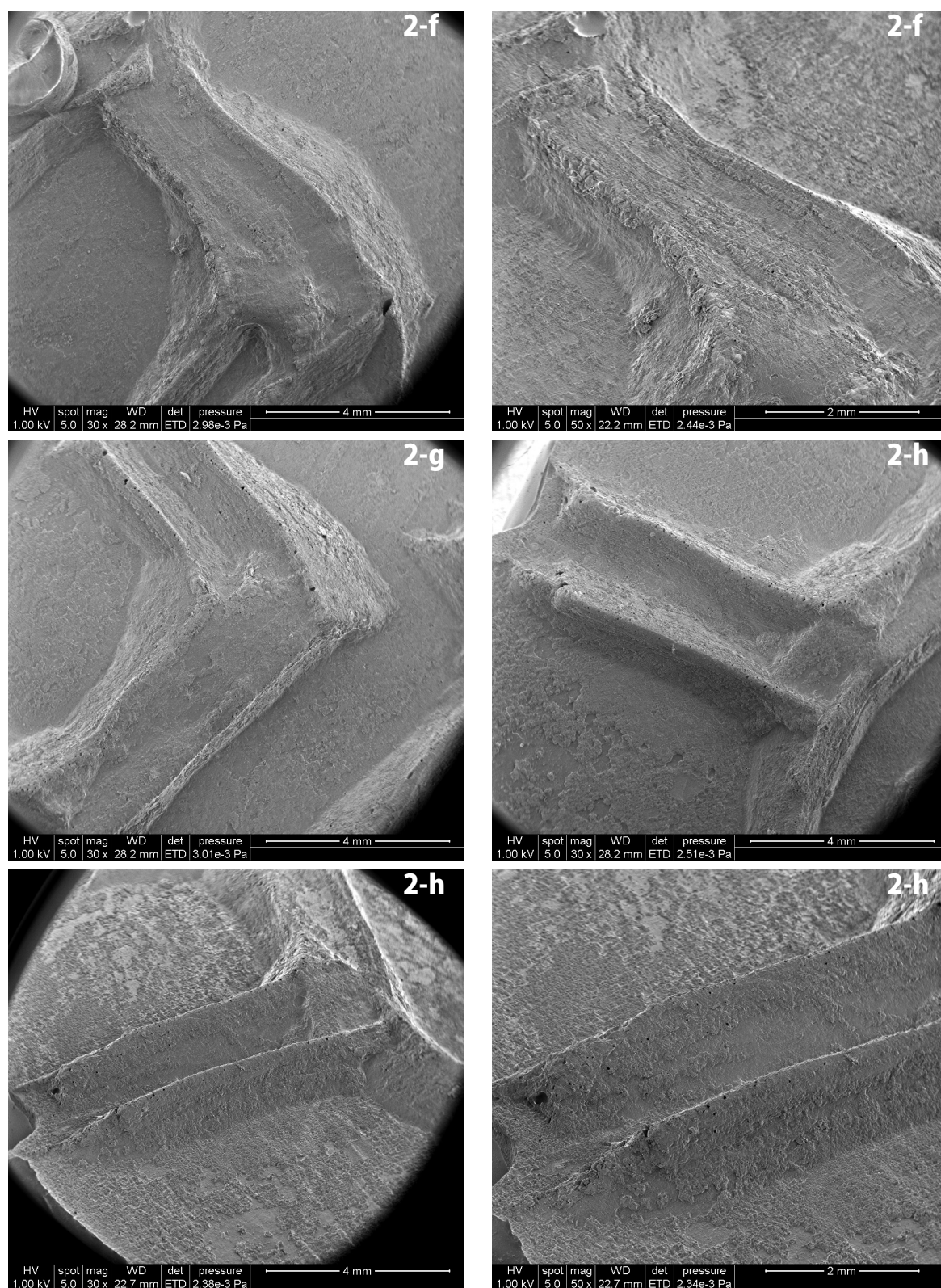


Figure 6.9: SEM images of seal discovered from the period IC(i) at Kunal

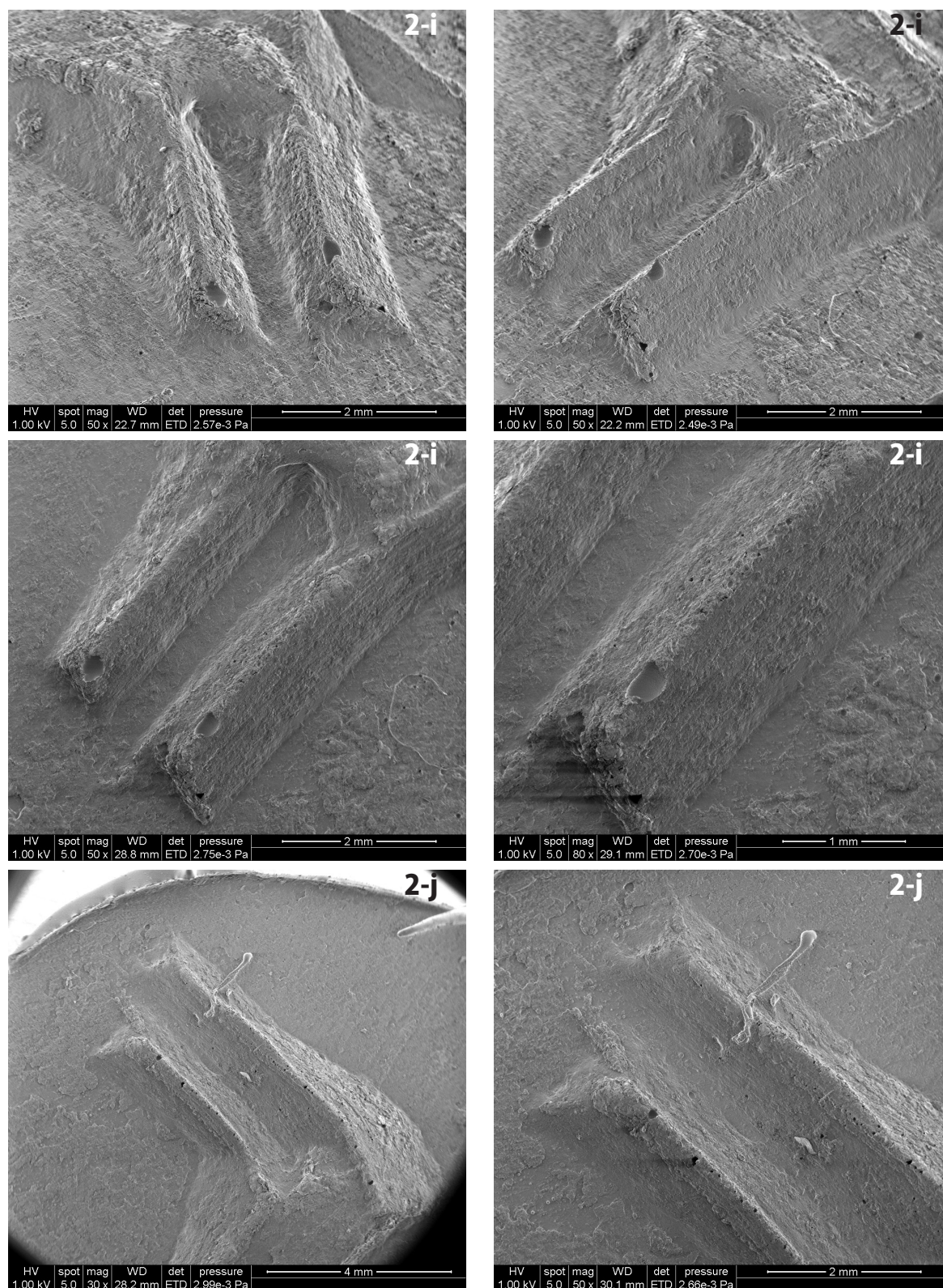


Figure 6.10: SEM images of seal discovered from the period IC(i) at Kunal

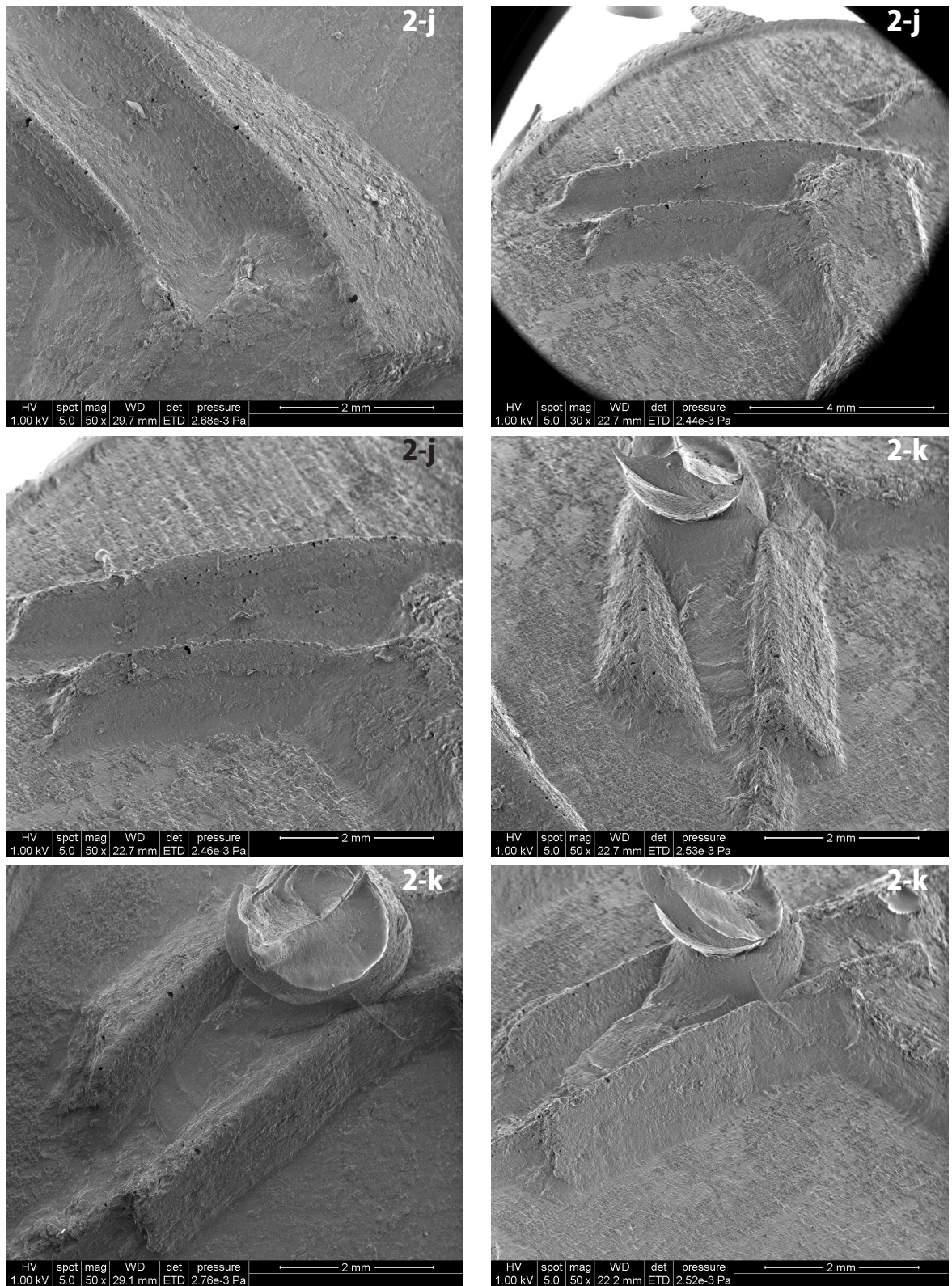


Figure 6.11: SEM images of seal discovered from the period IC(i) at Kunal

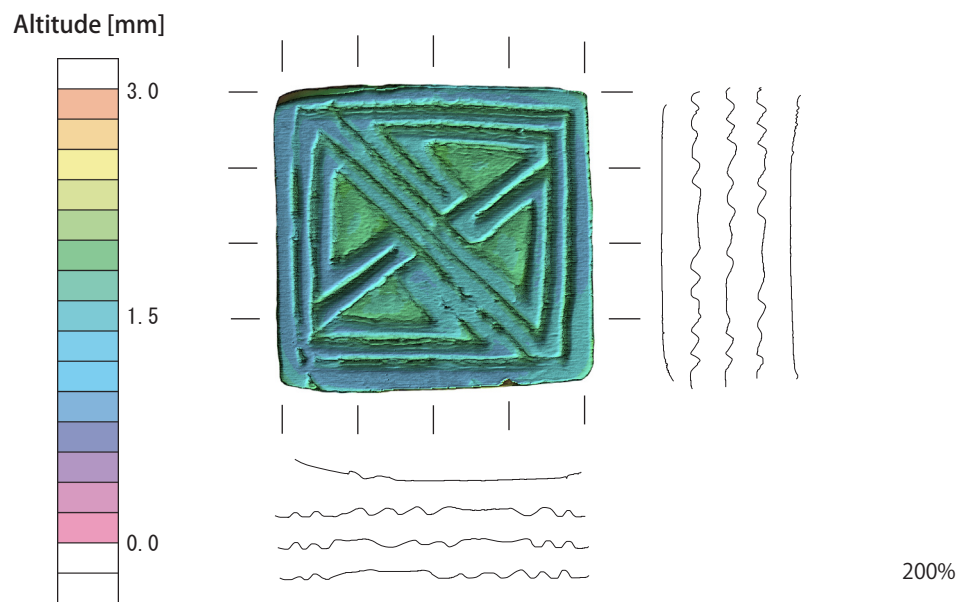


Figure 6.12: Photograph and PEAKIT image of seal discovered from the period IC(i) at Kunal (see also Figure 3.1-2)

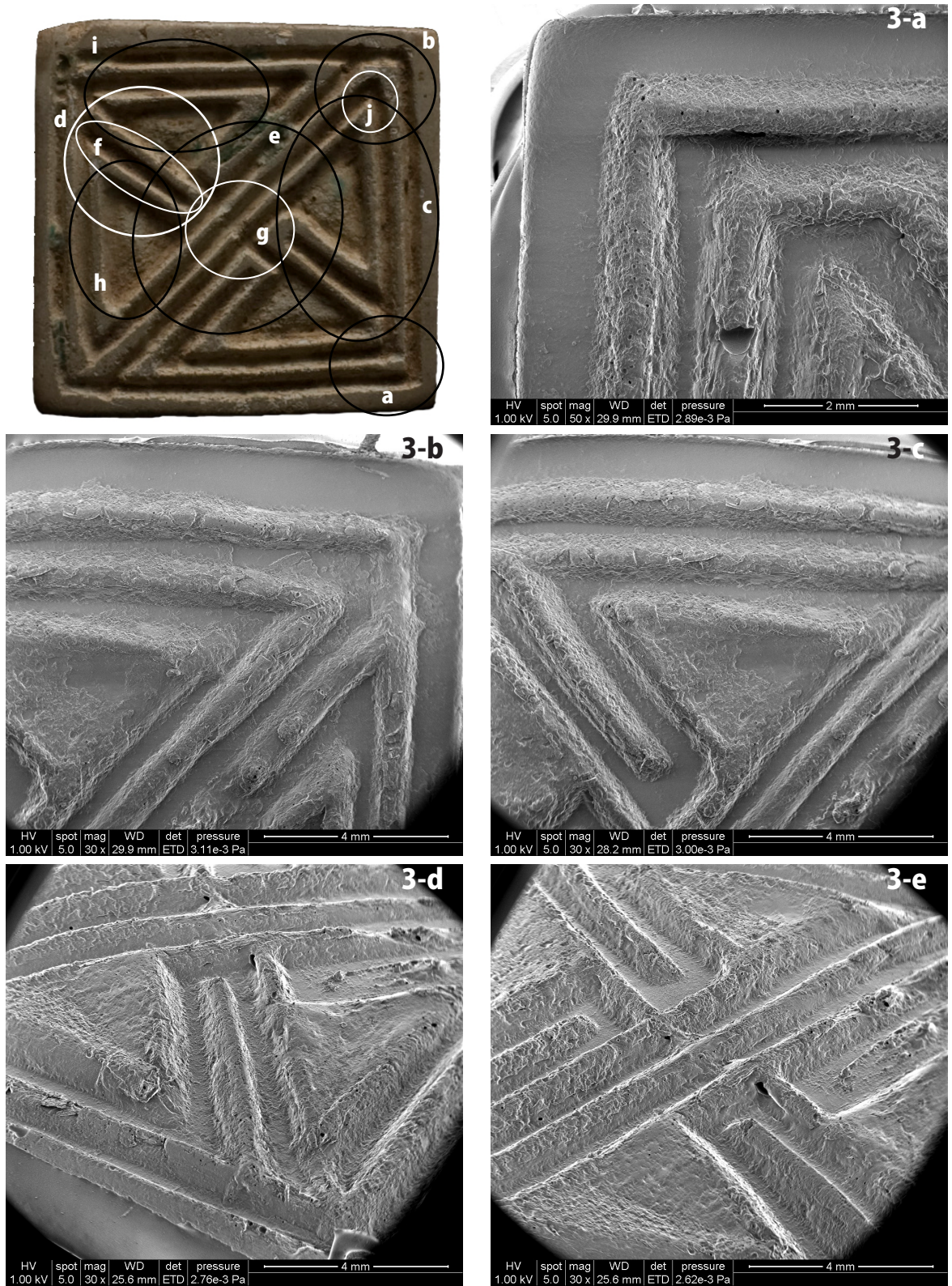


Figure 6.13: Photograph and SEM image of seal discovered from the period IC(i) at Kunal

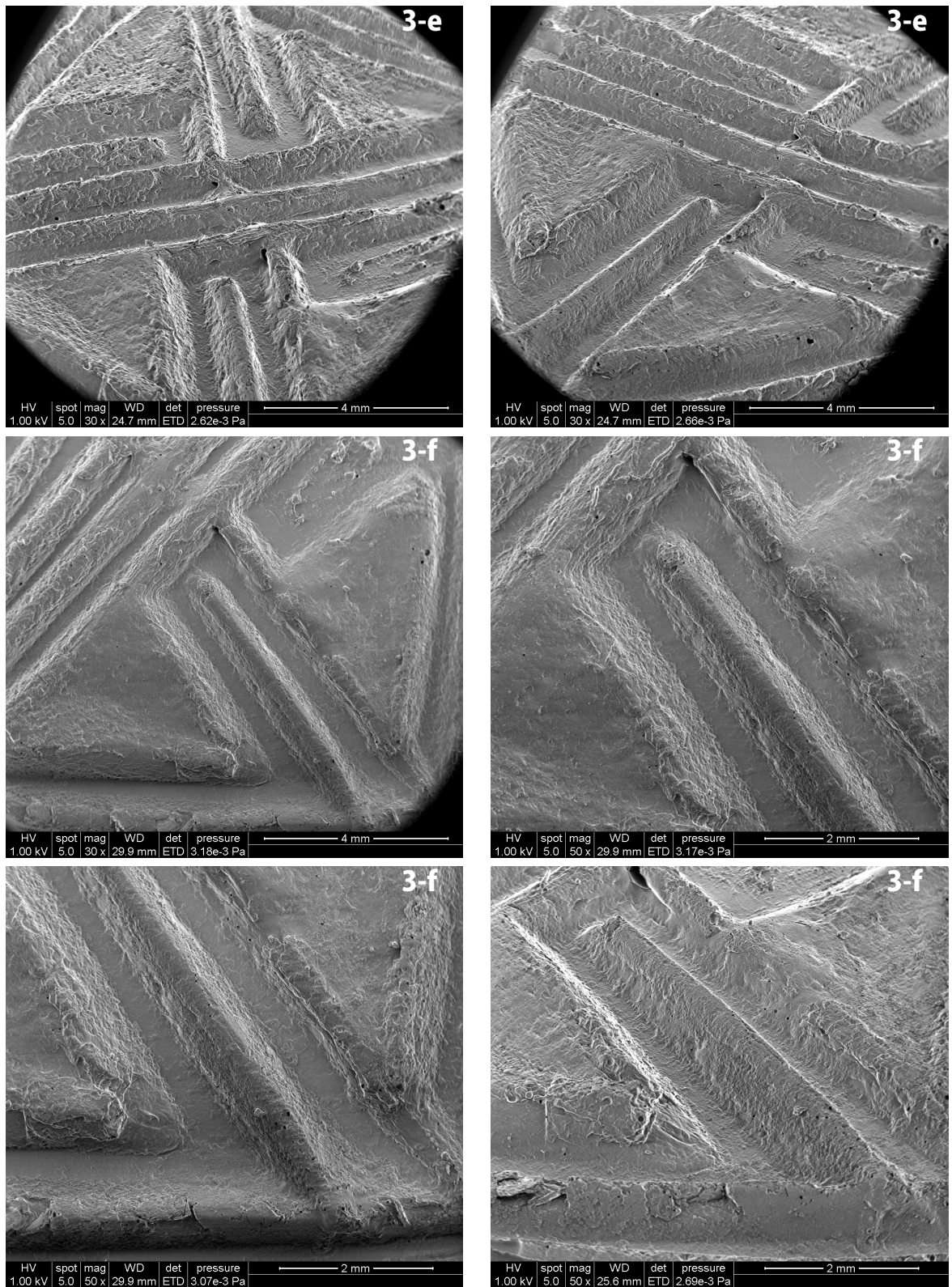


Figure 6.14: SEM images of seal discovered from the period IC(i) at Kunal

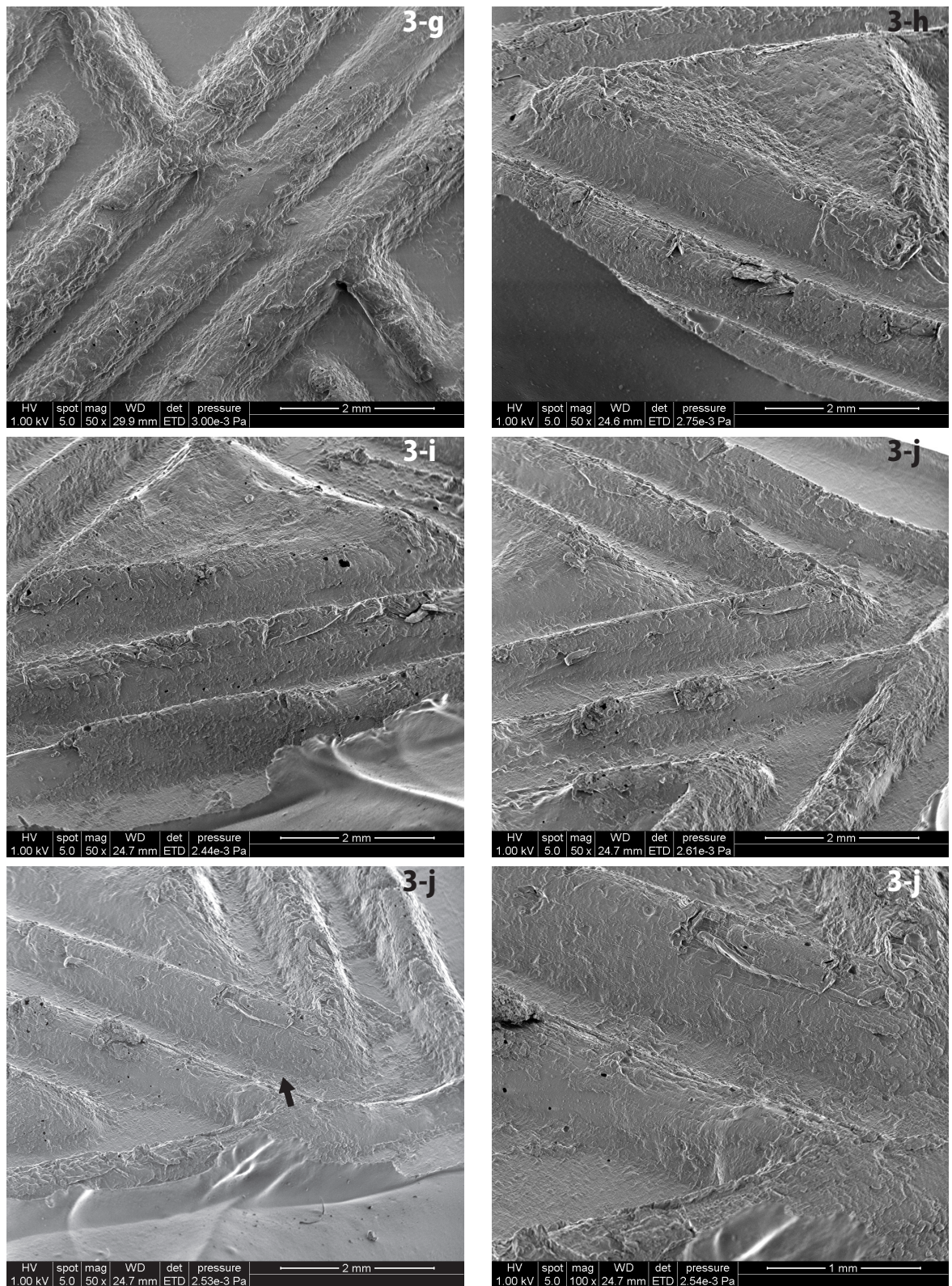


Figure 6.15: SEM images of seal discovered from the period IC(i) at Kunal

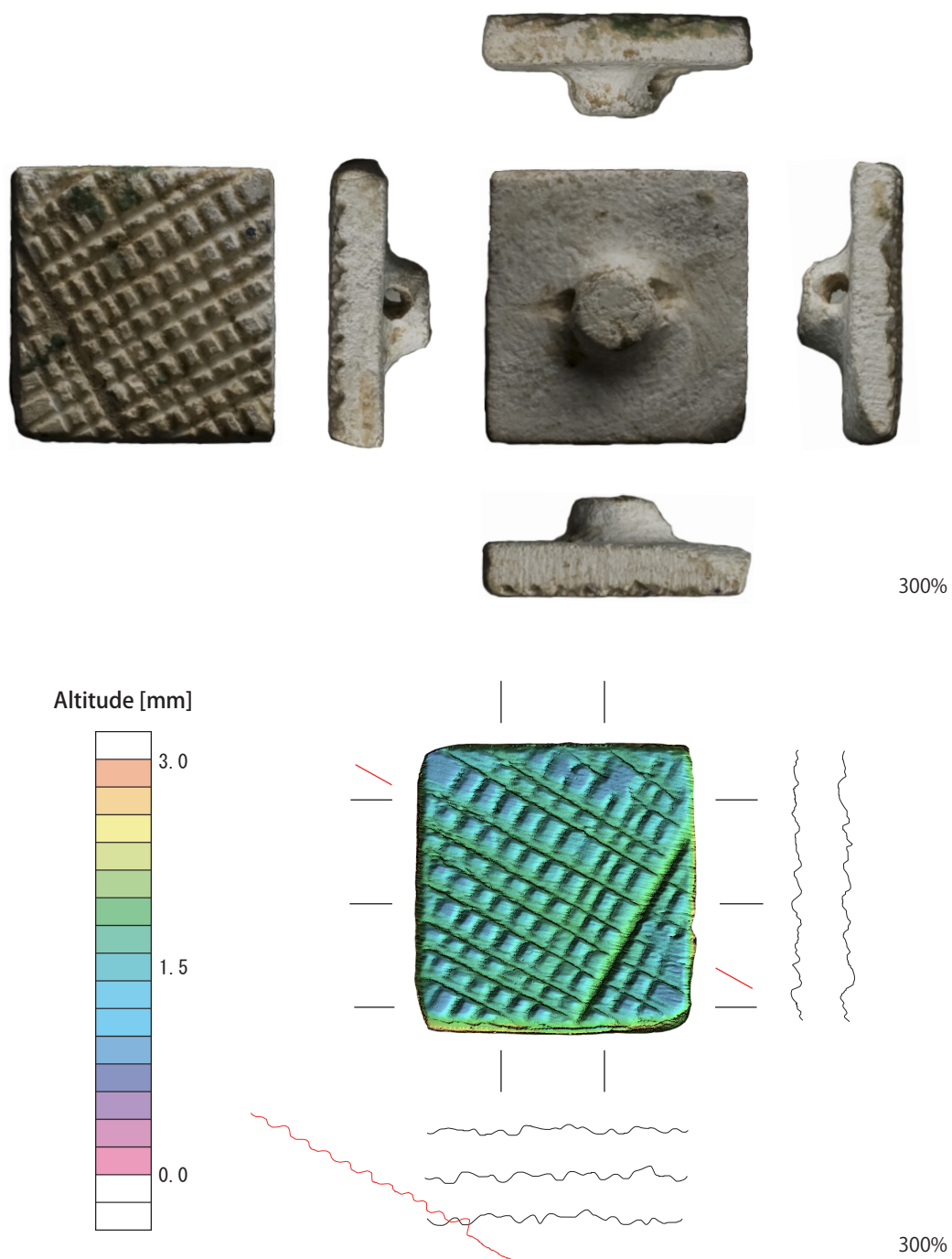


Figure 6.16: Photograph and PEAKIT image of seal discovered from the period IC(i) at Kunal (see also Figure 3.1-6)

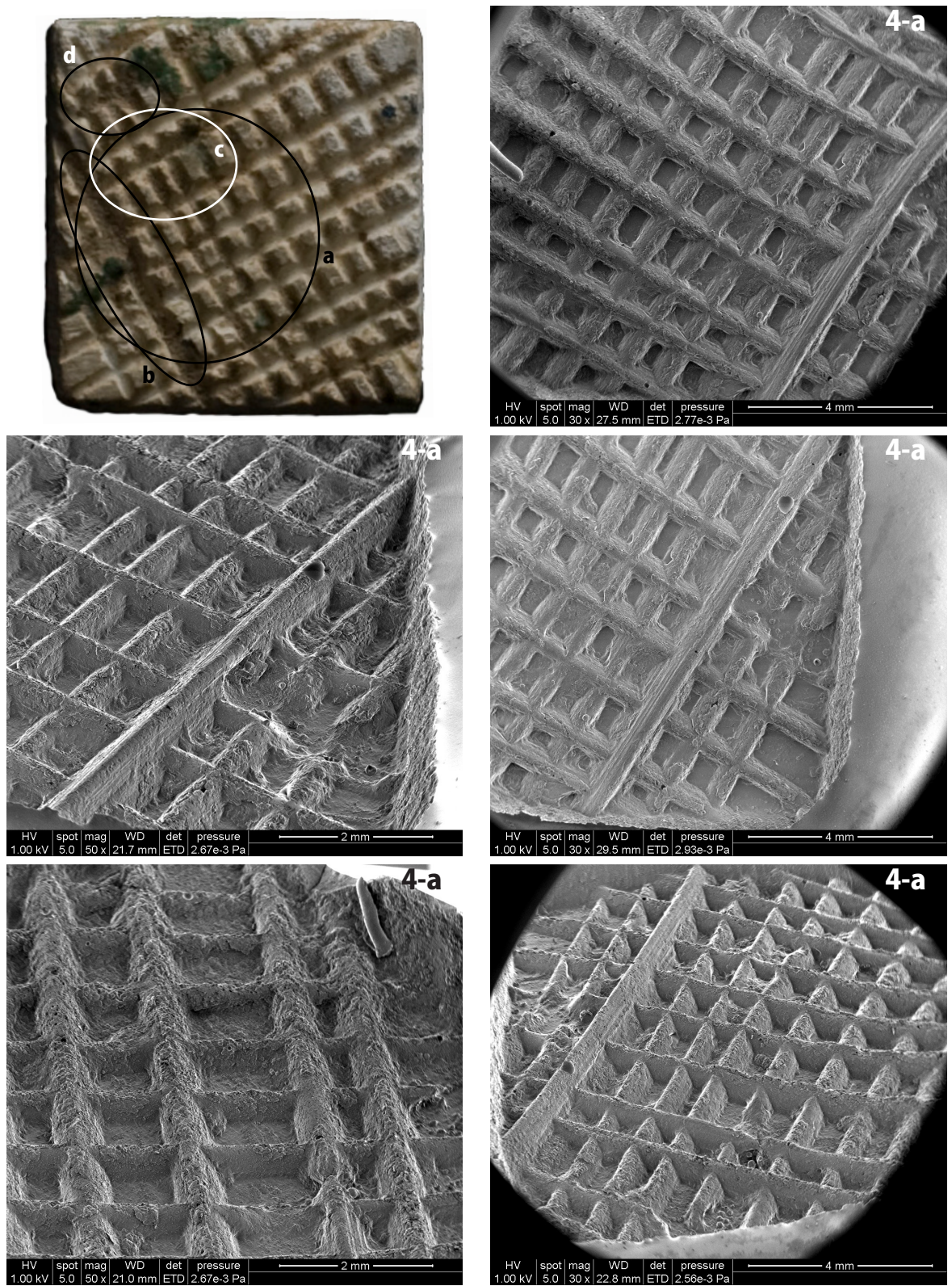


Figure 6.17: Photograph and SEM images of seal discovered from the period IC(i) at Kunal

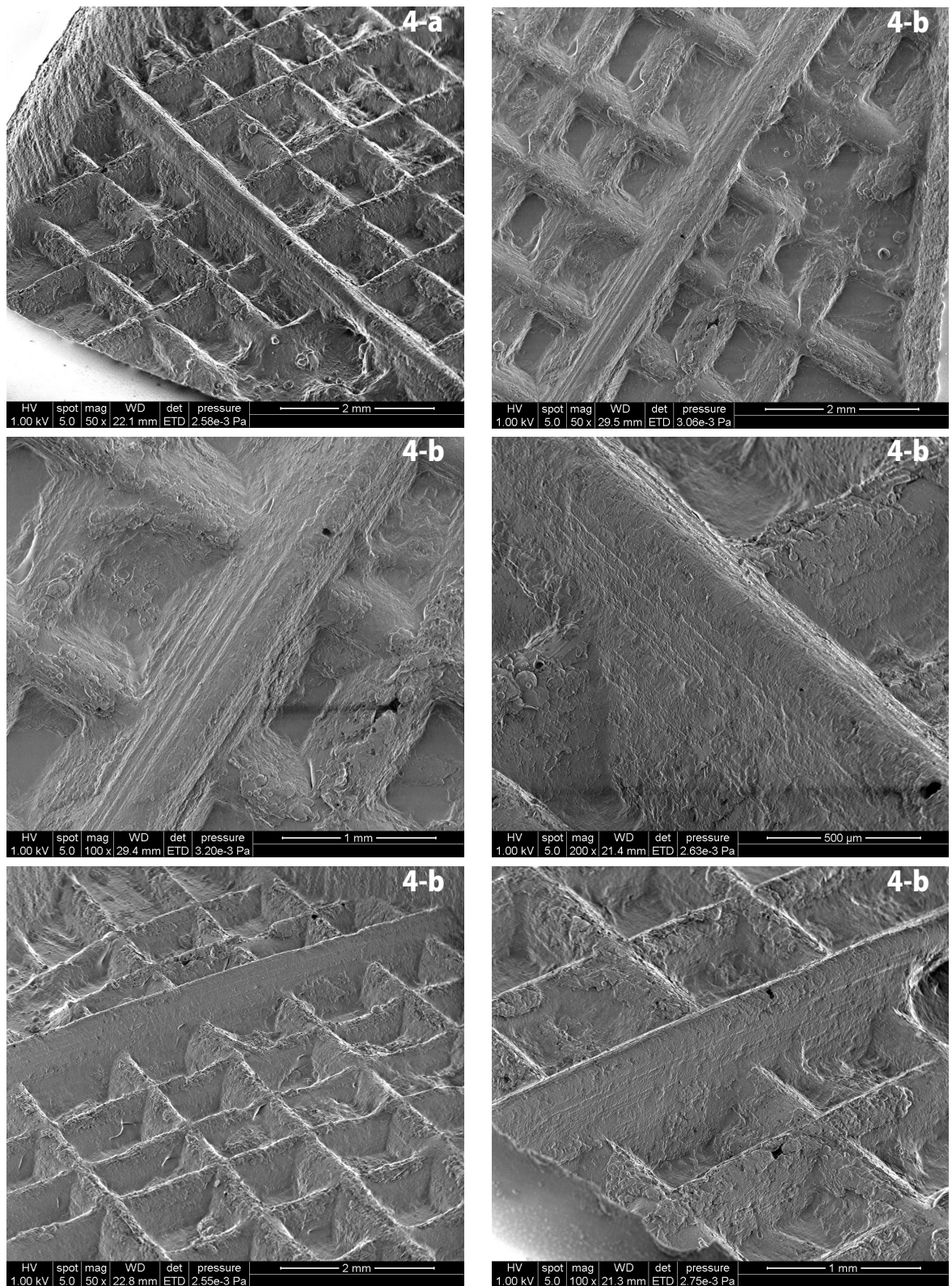


Figure 6.18: SEM images of seal discovered from the period IC(i) at Kunal

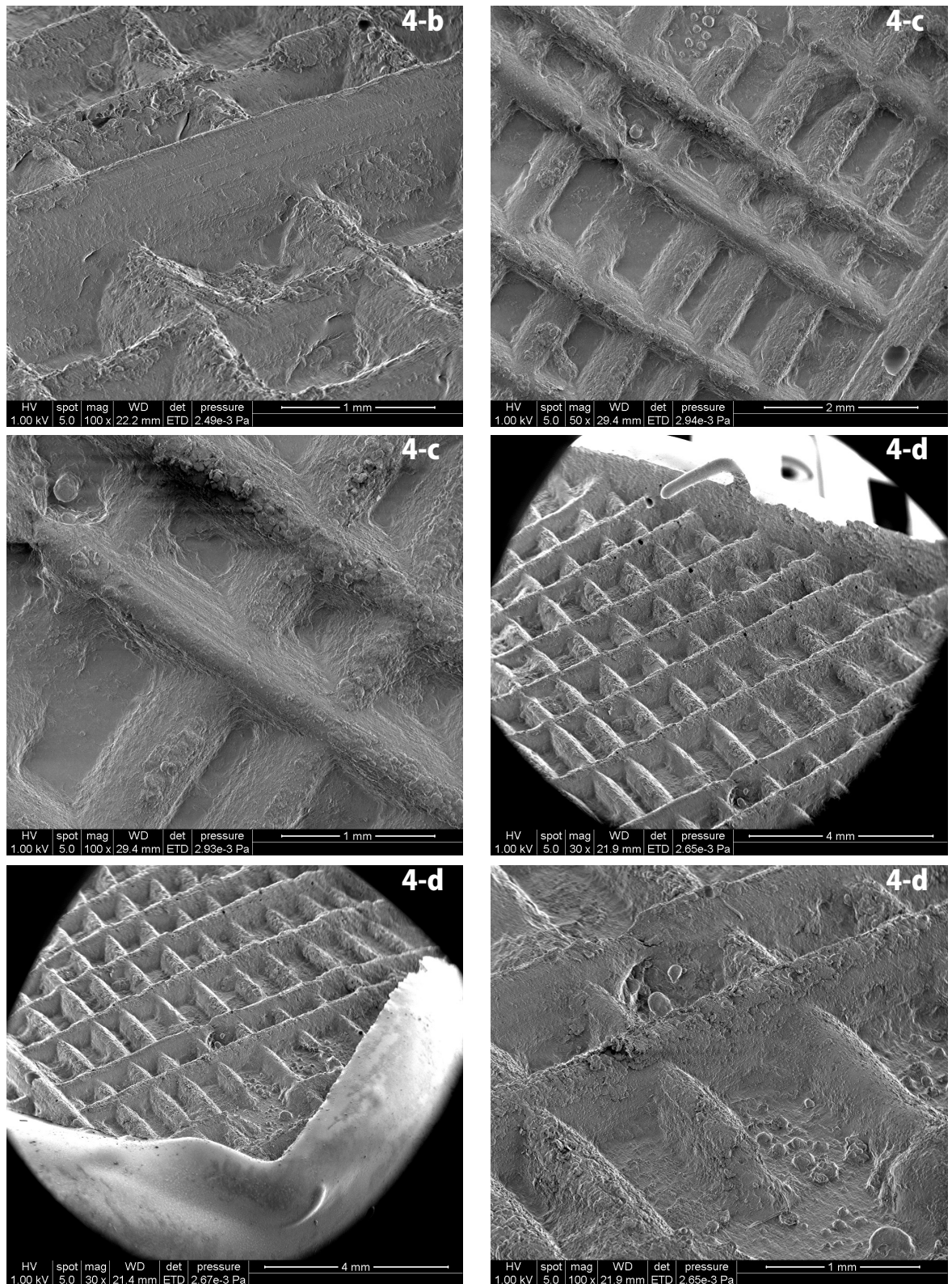
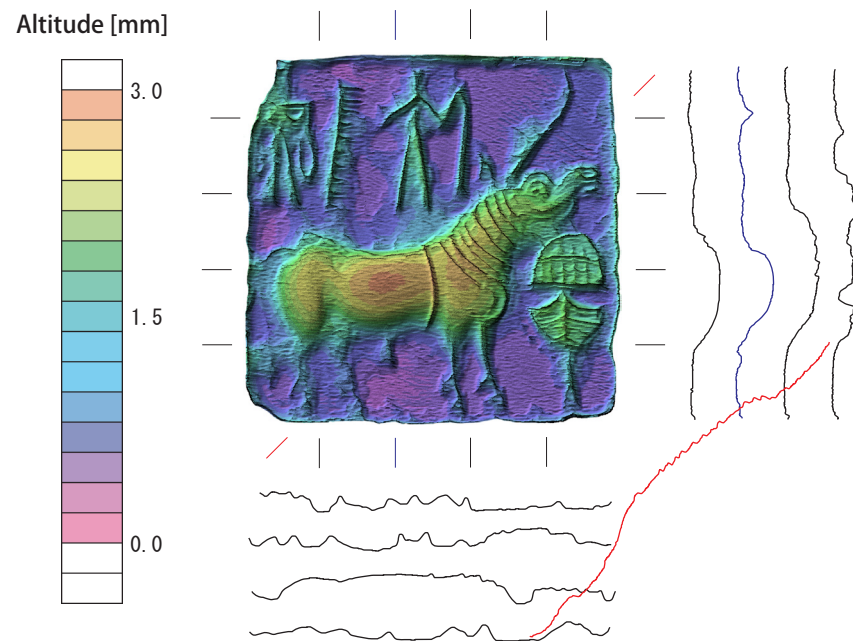


Figure 6.19: SEM images of seal discovered from the period IC(i) at Kunal



150%



200%

Figure 6.20: Photograph and PEAKIT image of Harappan seal stored in the Okayama Orient Mueum (see also Figure 1.1-3)



Figure 6.21: Photographs of Harappan seal stored in the Okayama Orient Museum (see also Figure 1.1-3)

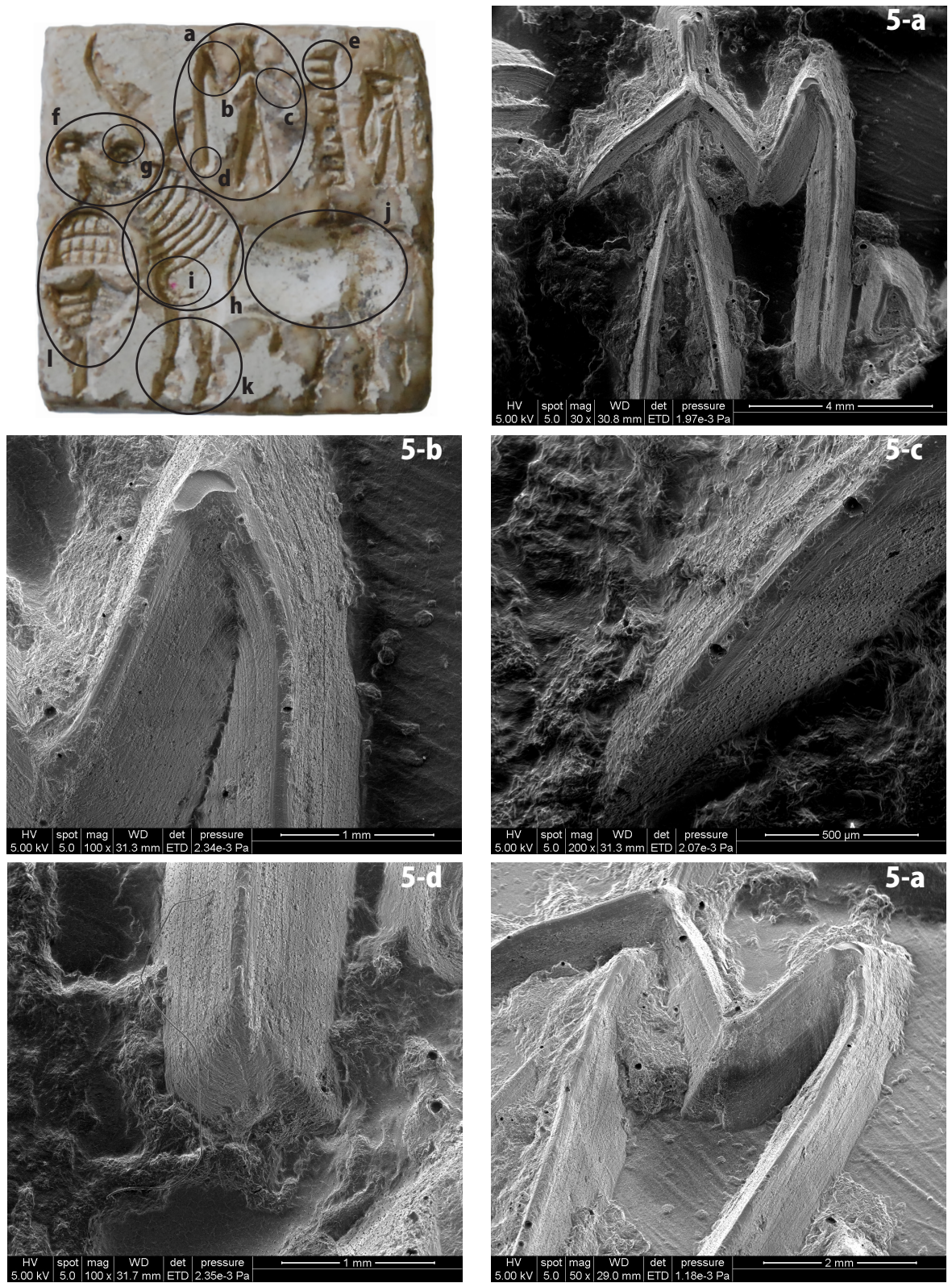


Figure 6.22: Photograph and SEM images of Harappan seal stored in the Okayama Orient Mueum

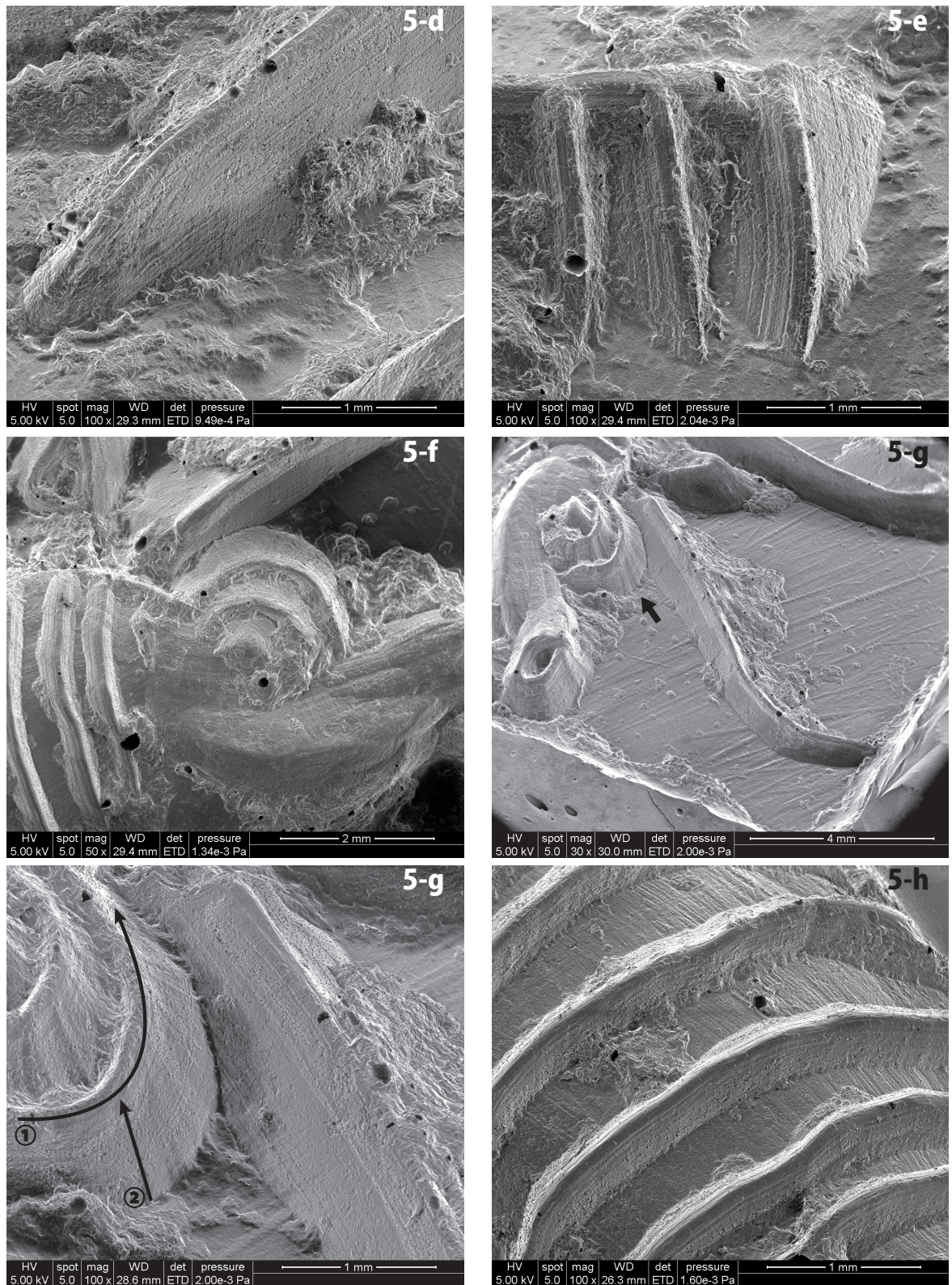


Figure 6.23: SEM images of Harappan seal stored in the Okayama Orient Museum

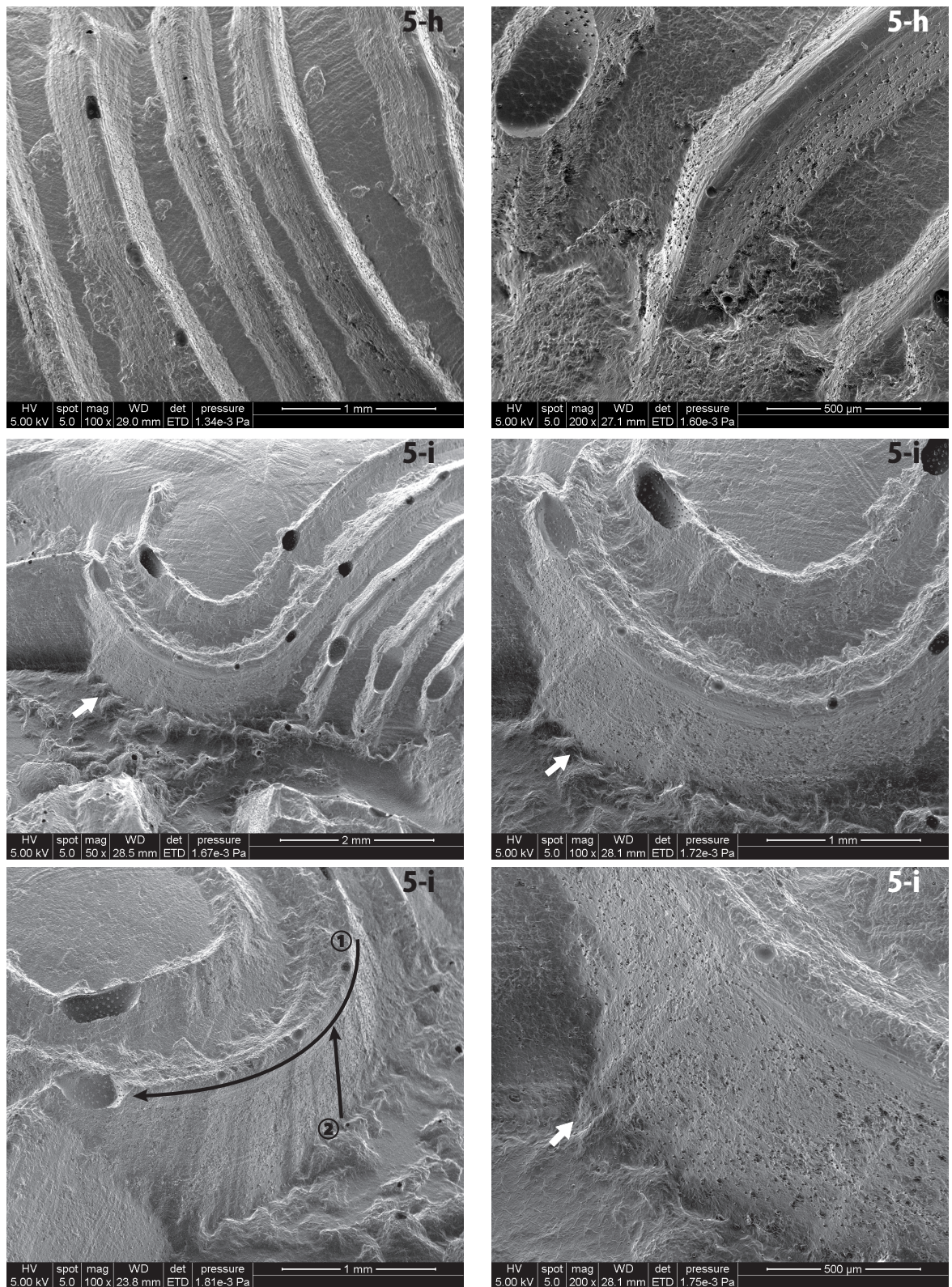


Figure 6.24: SEM images of Harappan seal stored in the Okayama Orient Mueum

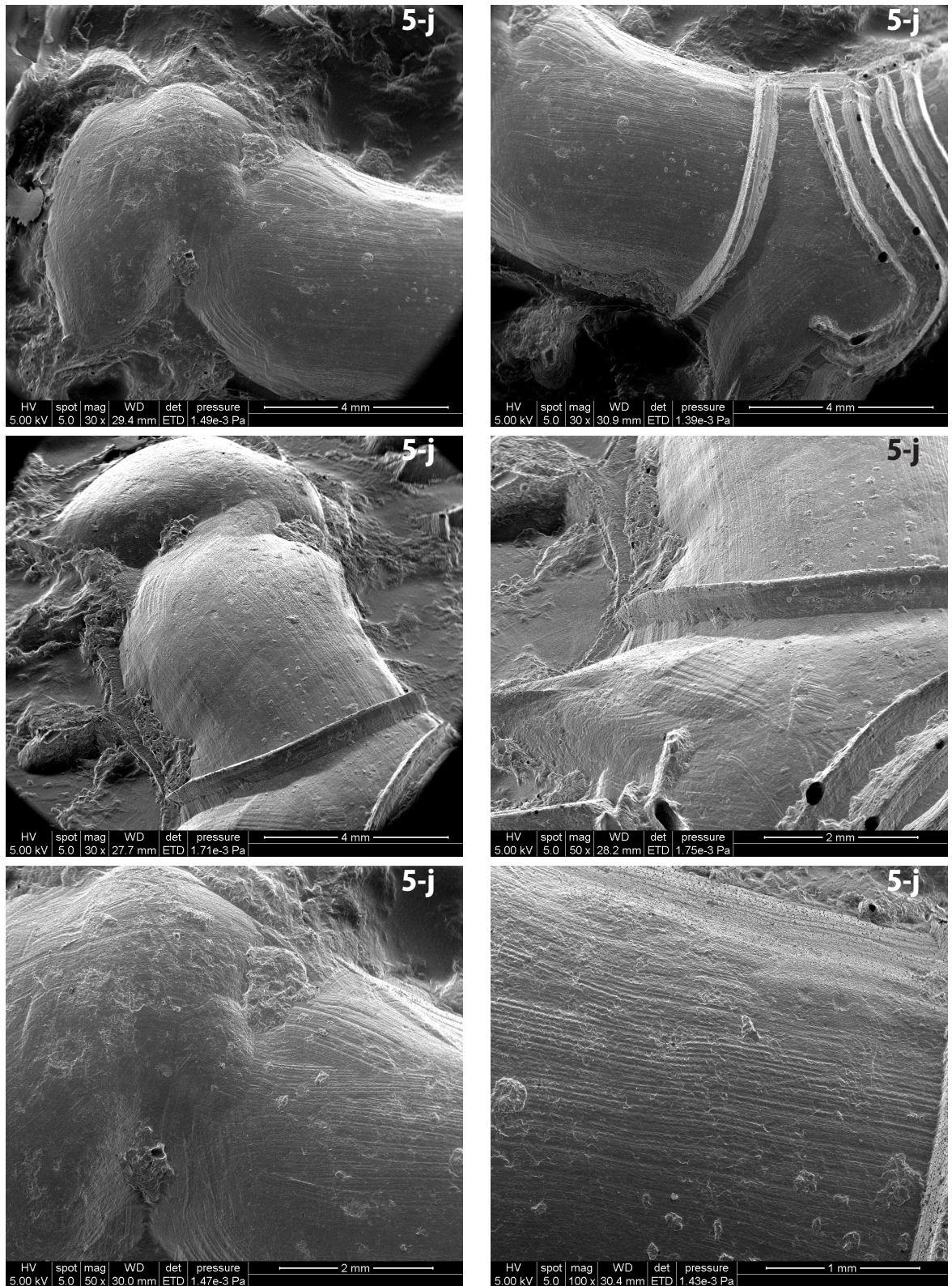


Figure 6.25: SEM images of Harappan seal stored in the Okayama Orient Museum

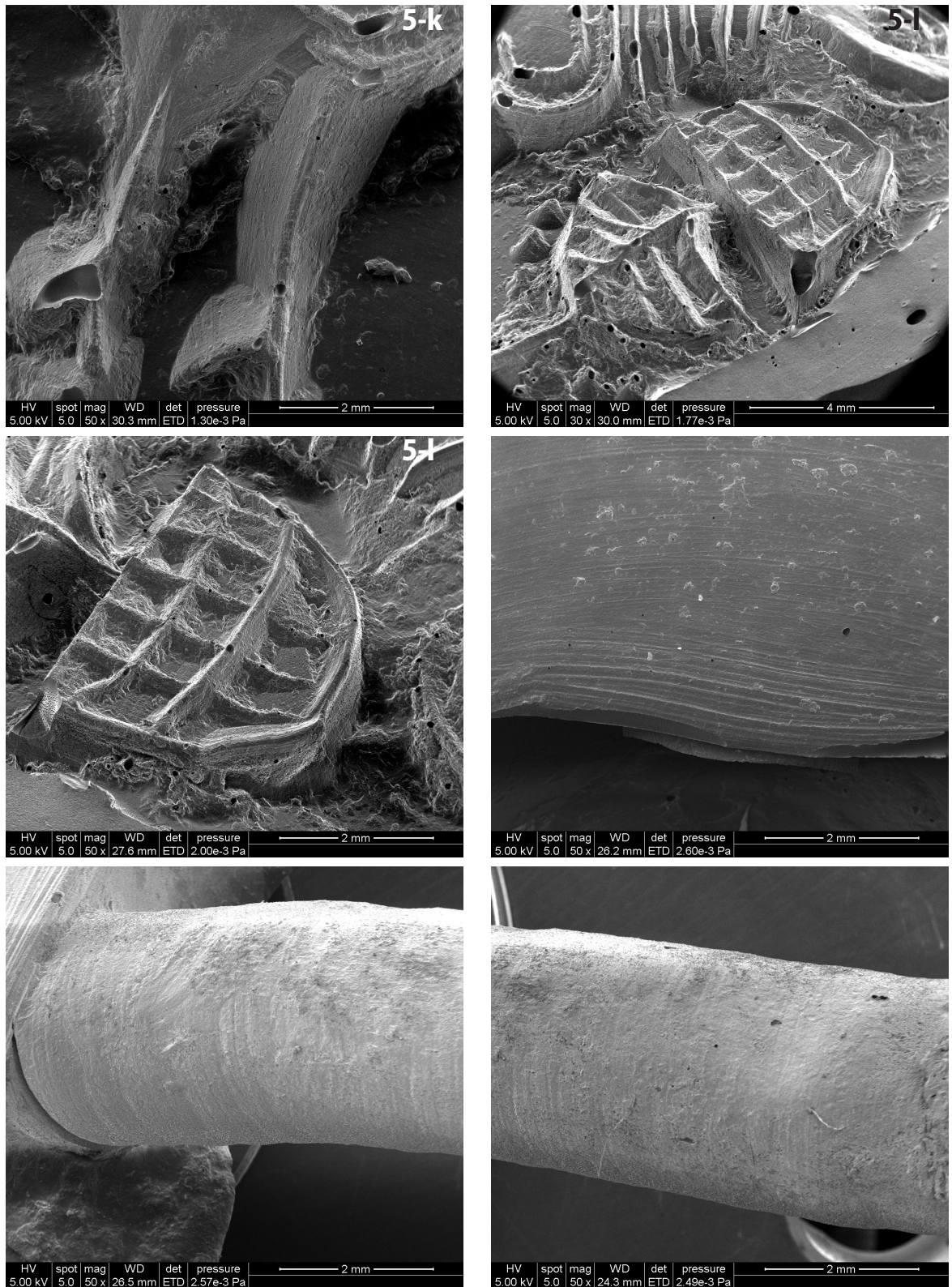
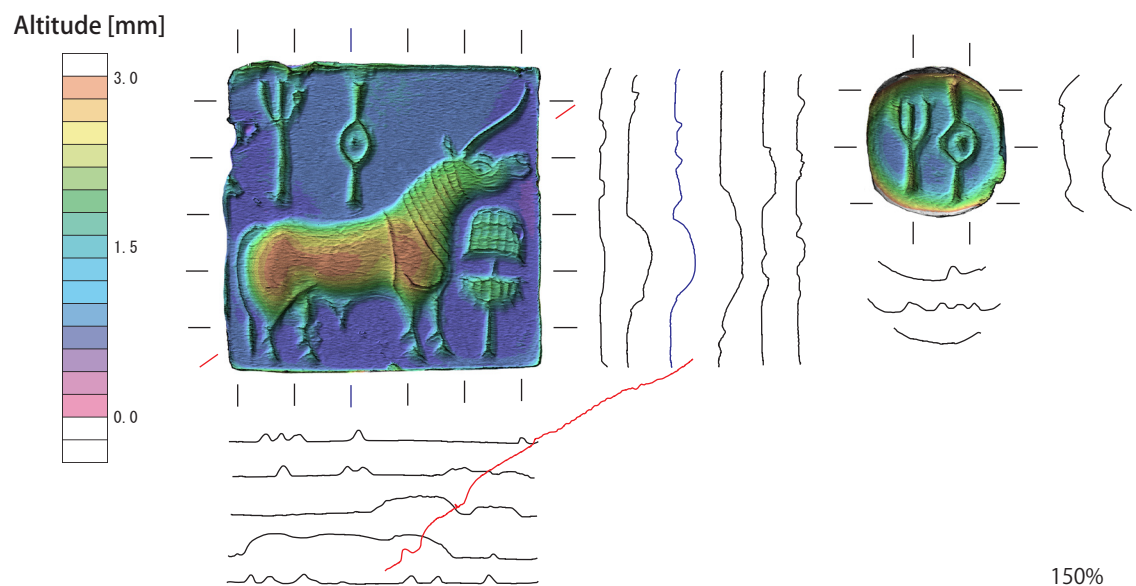


Figure 6.26: SEM images of Harappan seal stored in the Okayama Orient Museum



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150%

Figure 6.27: Photograph and PEAKIT images of Harappan seal discovered from the period II of Farmana (see also Figure 1.1-1)

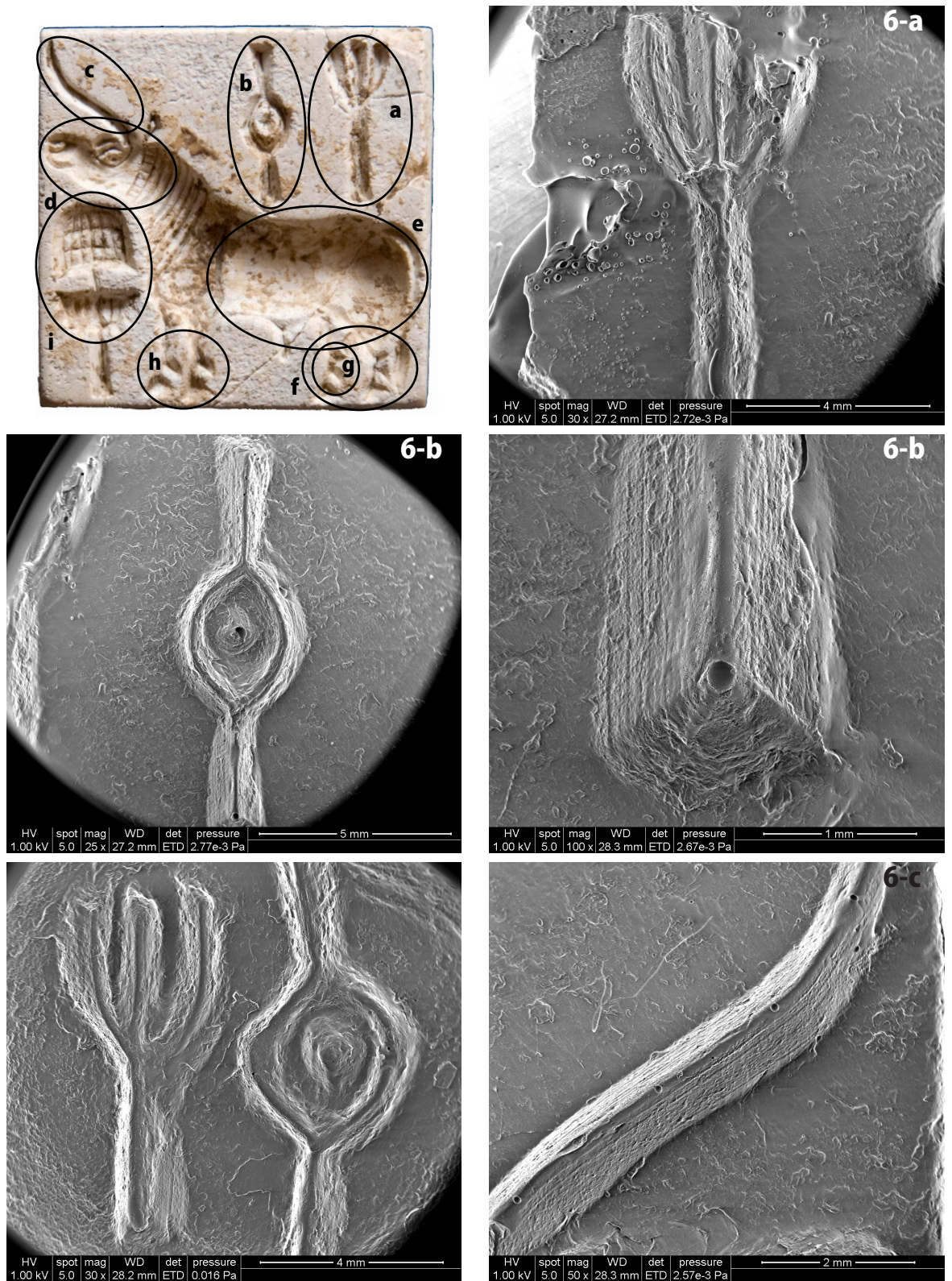


Figure 6.28: Photograph and SEM images of Harappan seal discovered from the period II of Farmana

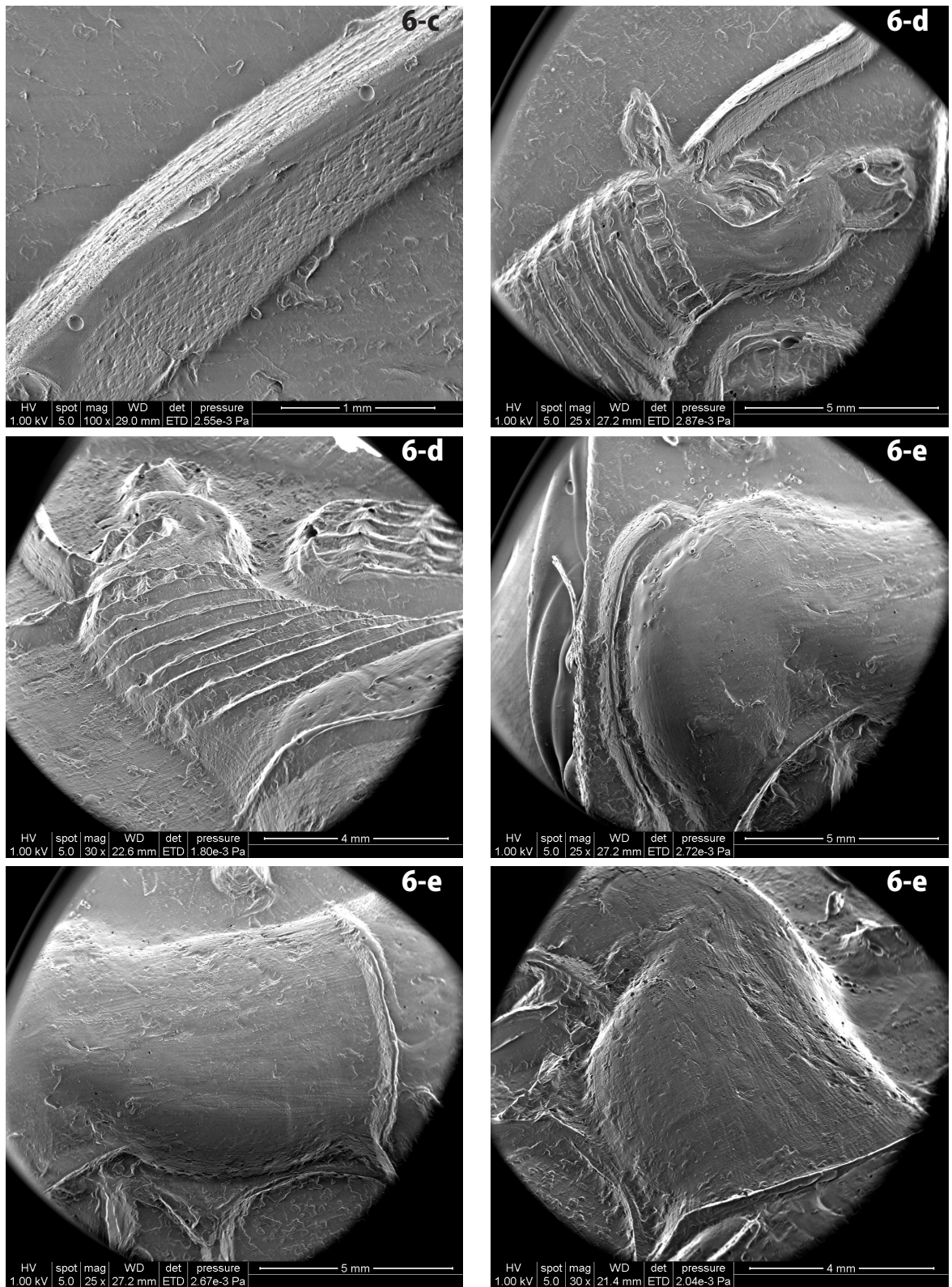


Figure 6.29: SEM images of Harappan seal discovered from the period II of Farmana

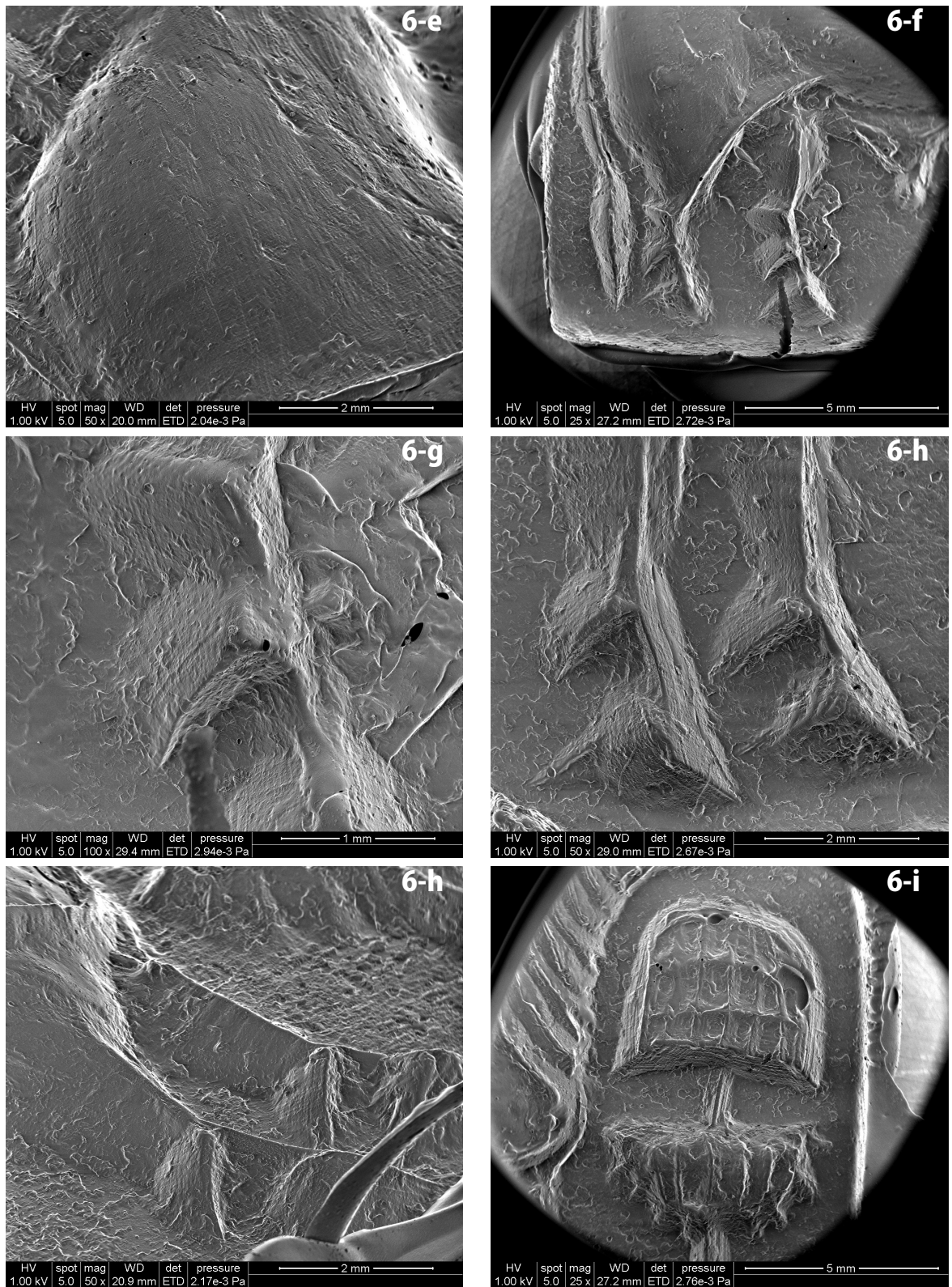
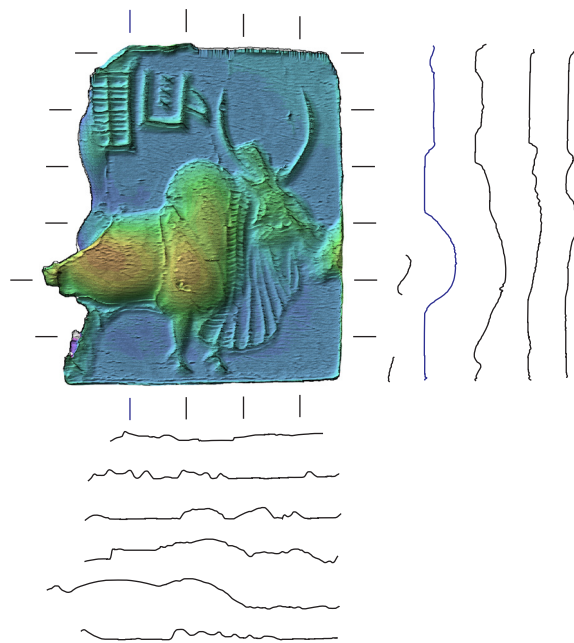


Figure 6.30: SEM images of Harappan seal discovered from the period II of Farmana



150%

Altitude [mm]



150%

Figure 6.31: Photograph and PEAKit image of Harappan seal discovered from the period II of Farmana (see also Figure 1.1-2)

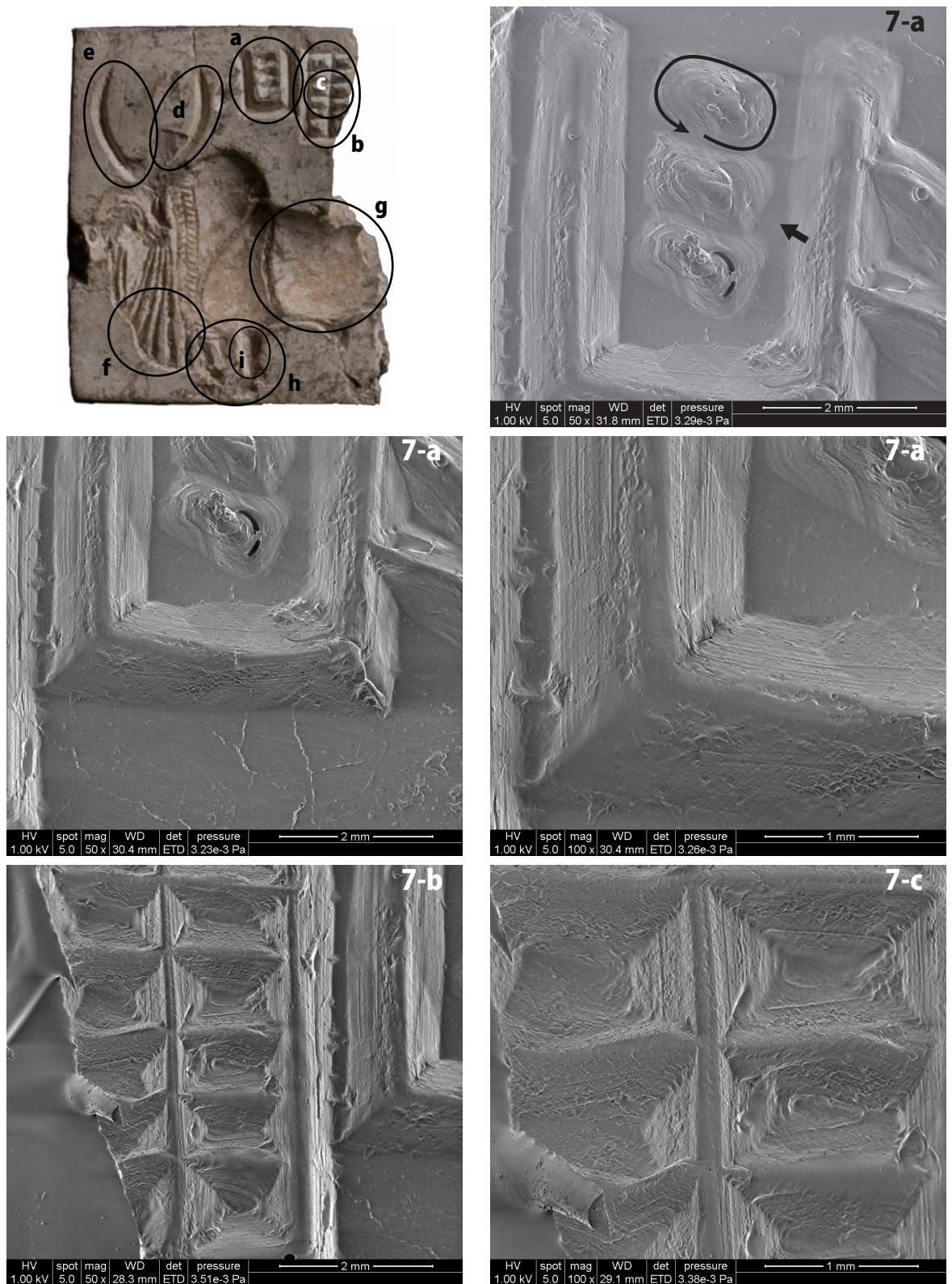


Figure 6.32: Photograph and SEM images of Harappan seal discovered from the period II of Farmana

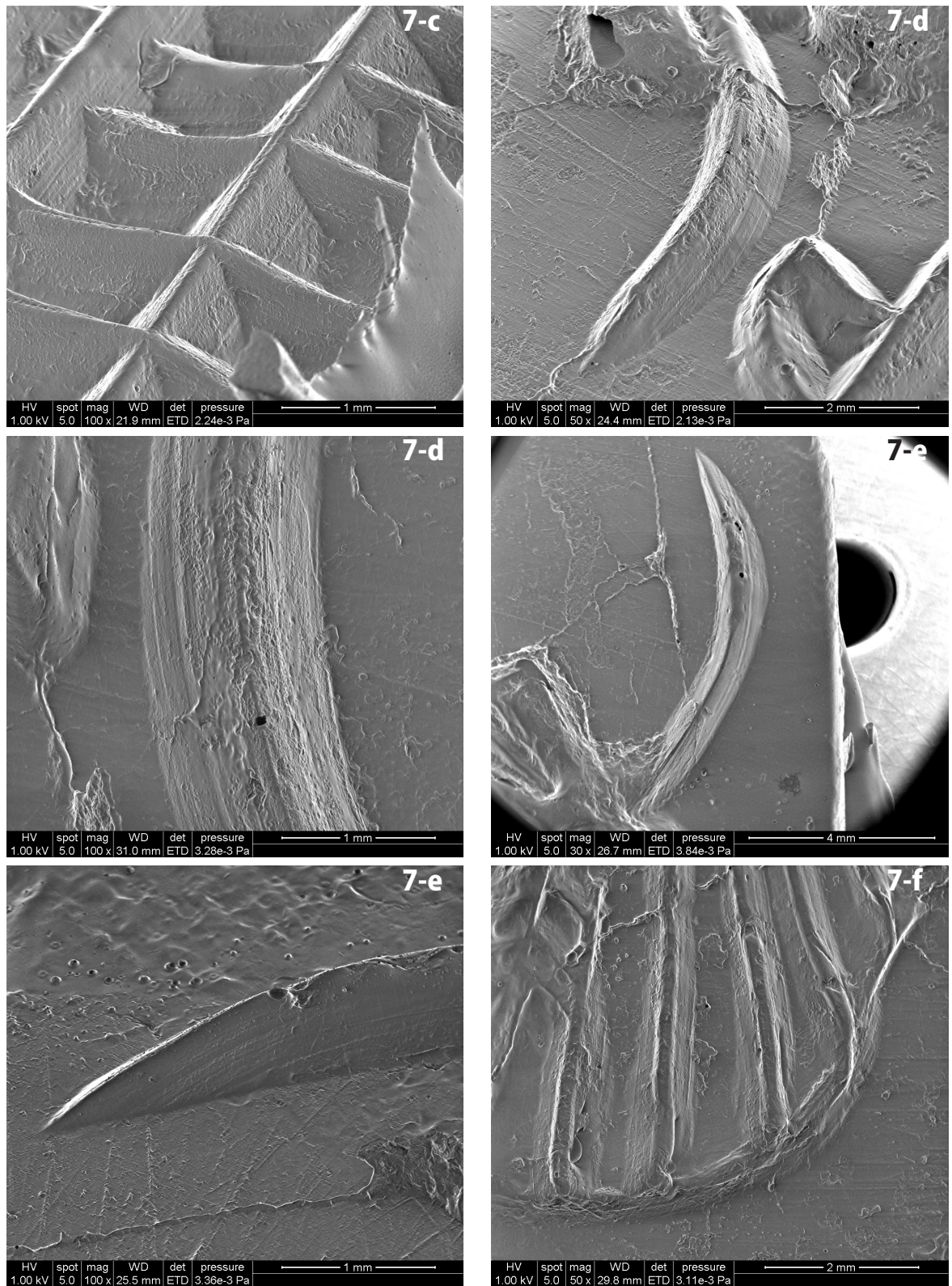


Figure 6.33: SEM images of Harappan seal discovered from the period II of Farmana

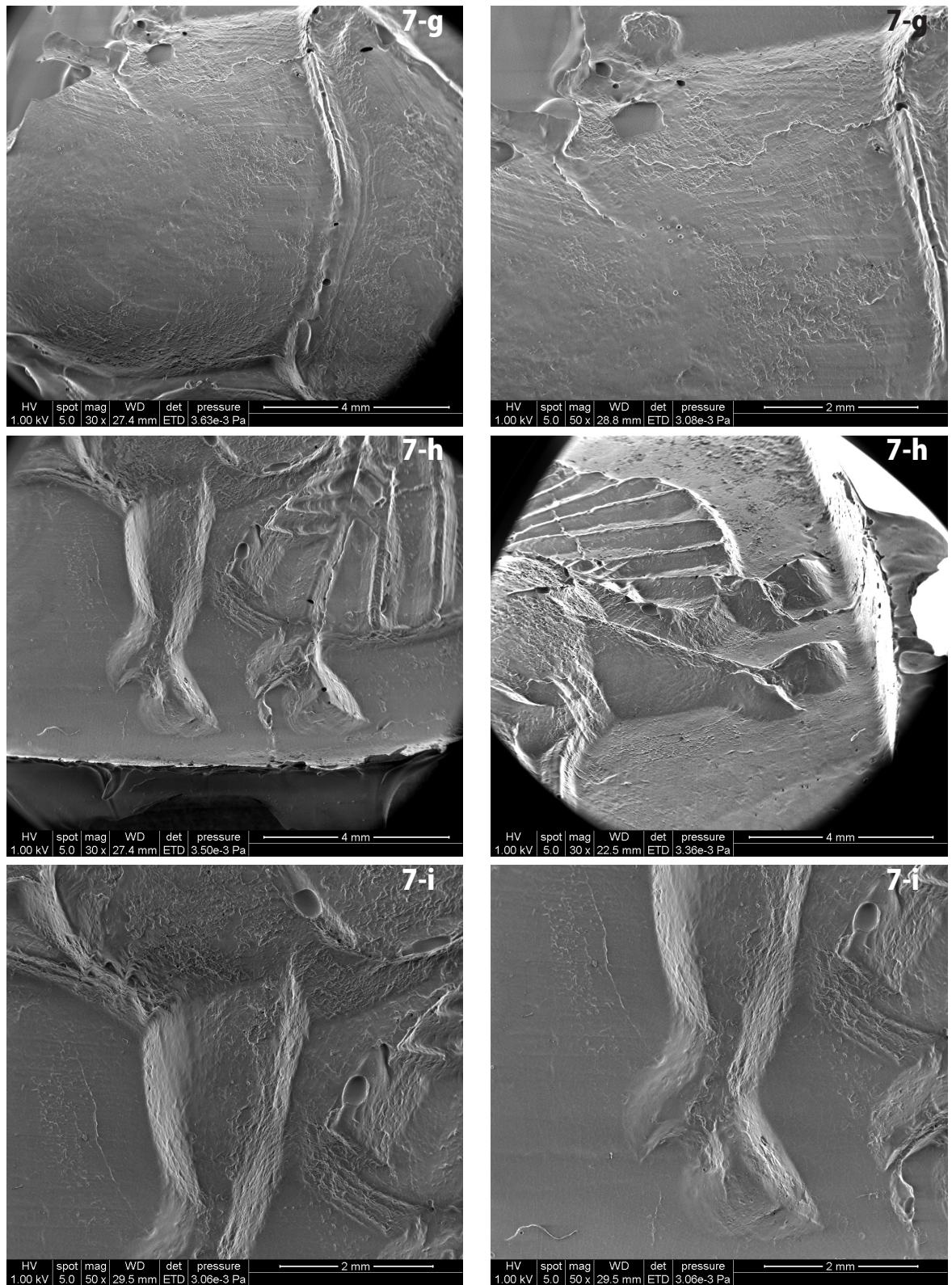


Figure 6.34: SEM images of Harappan seal discovered from the period II of Farmana

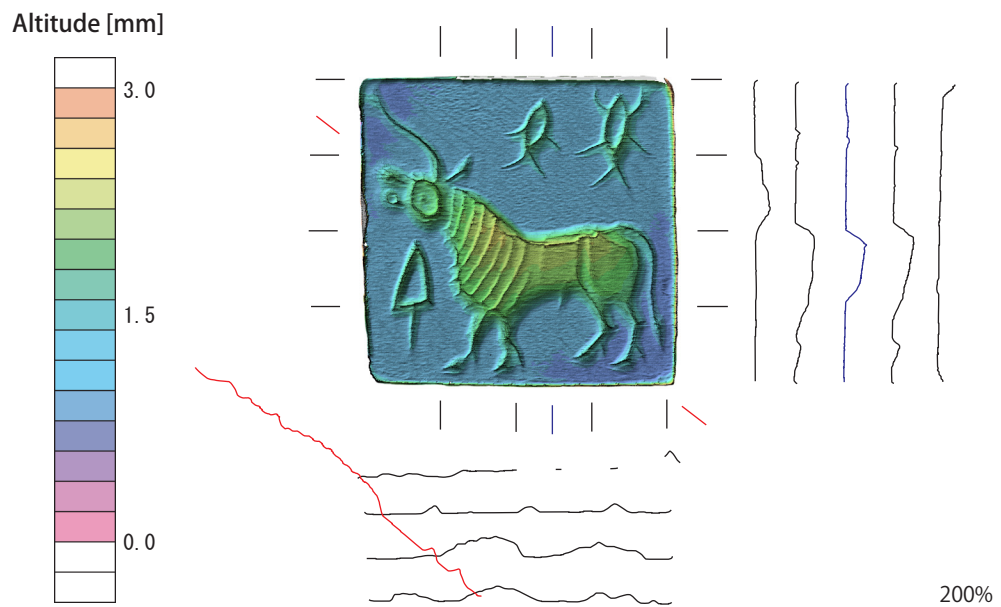


Figure 6.35: Photograph and PEAKIT image of Harappan seal discovered from the period II of Farmana (see also Figure 1.1-5)

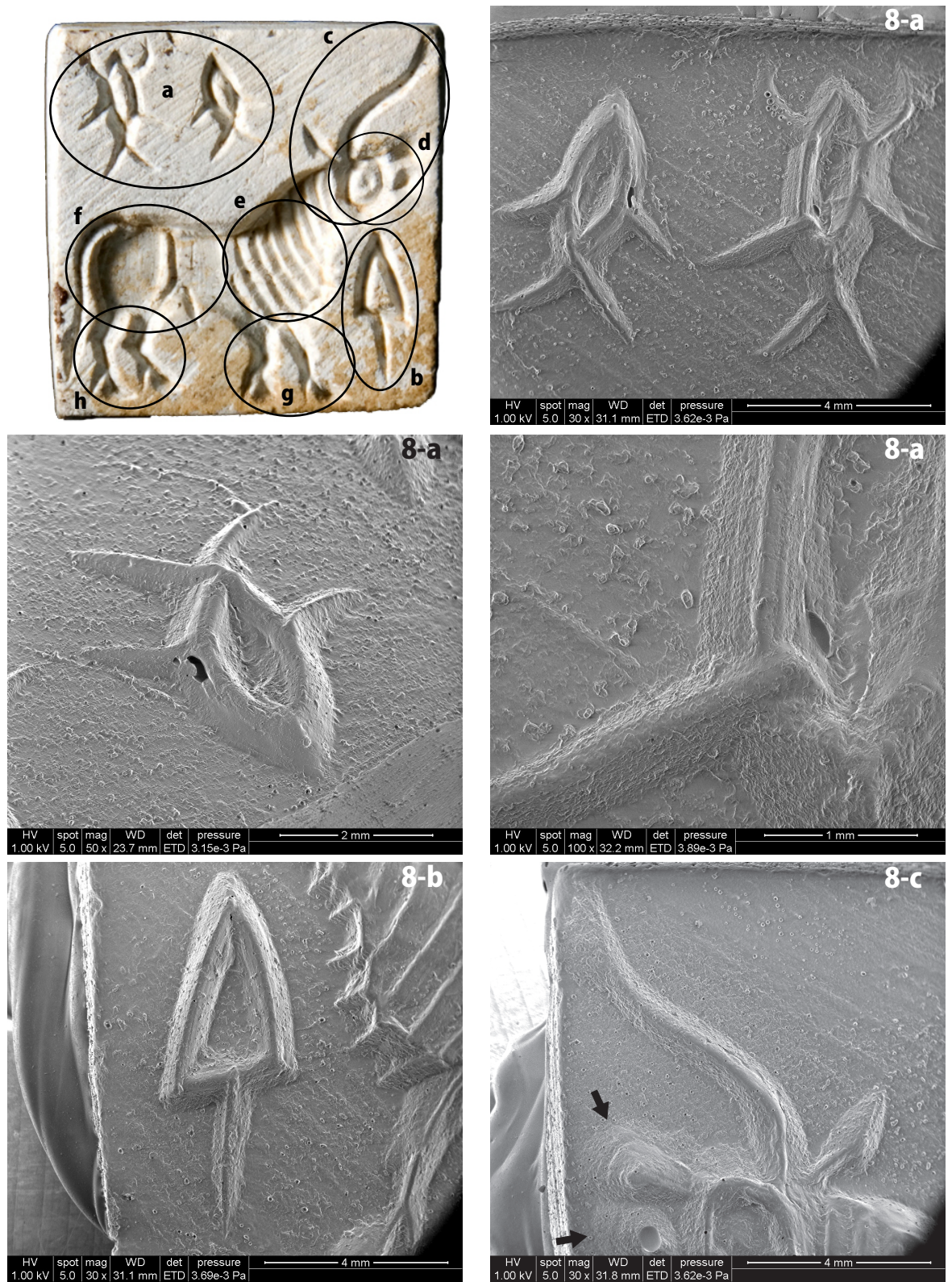


Figure 6.36: Photograph and SEM images of Harappan seal discovered from the period II of Farmana

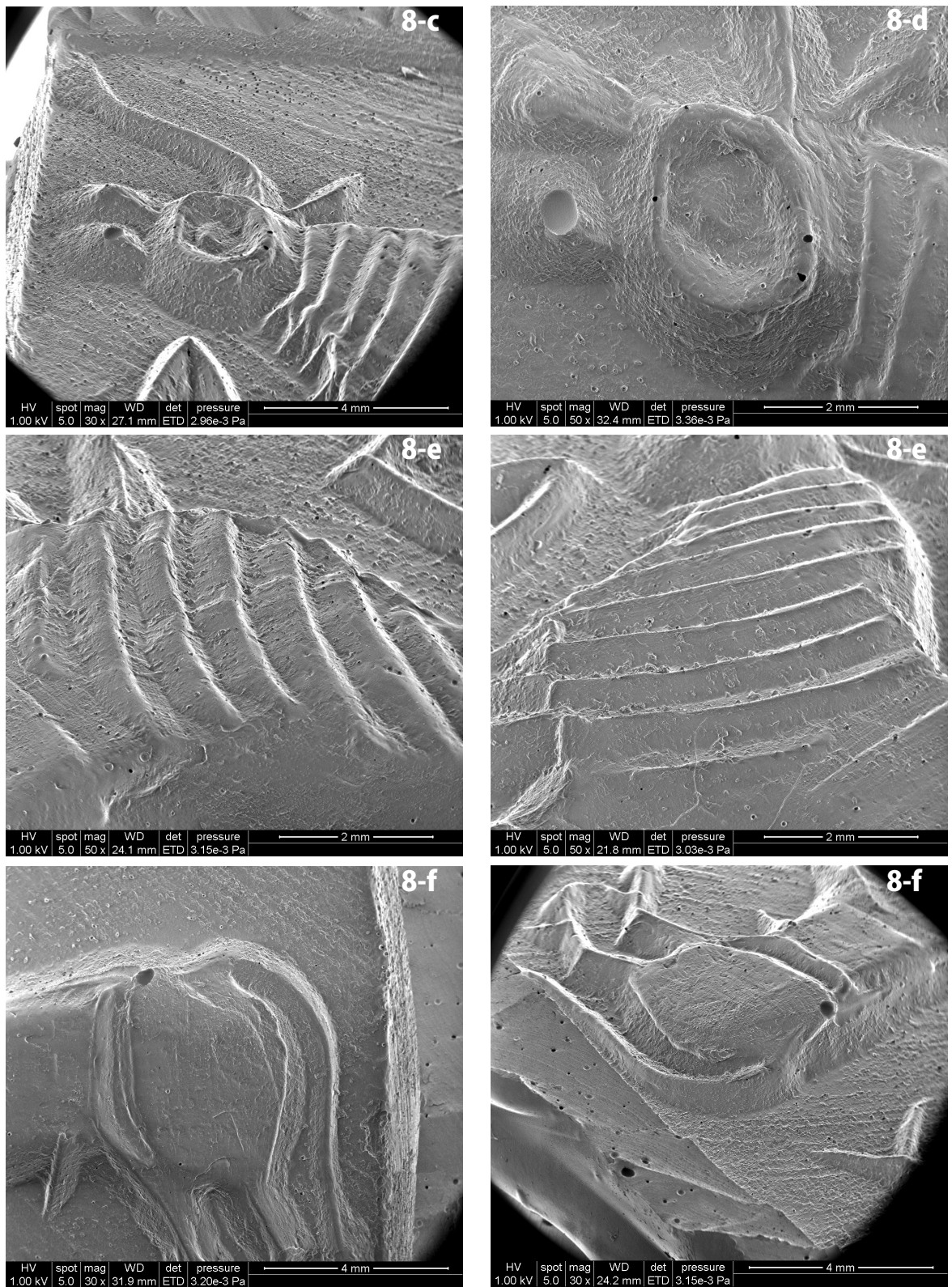


Figure 6.37: SEM images of Harappan seal discovered from the period II of Farmana

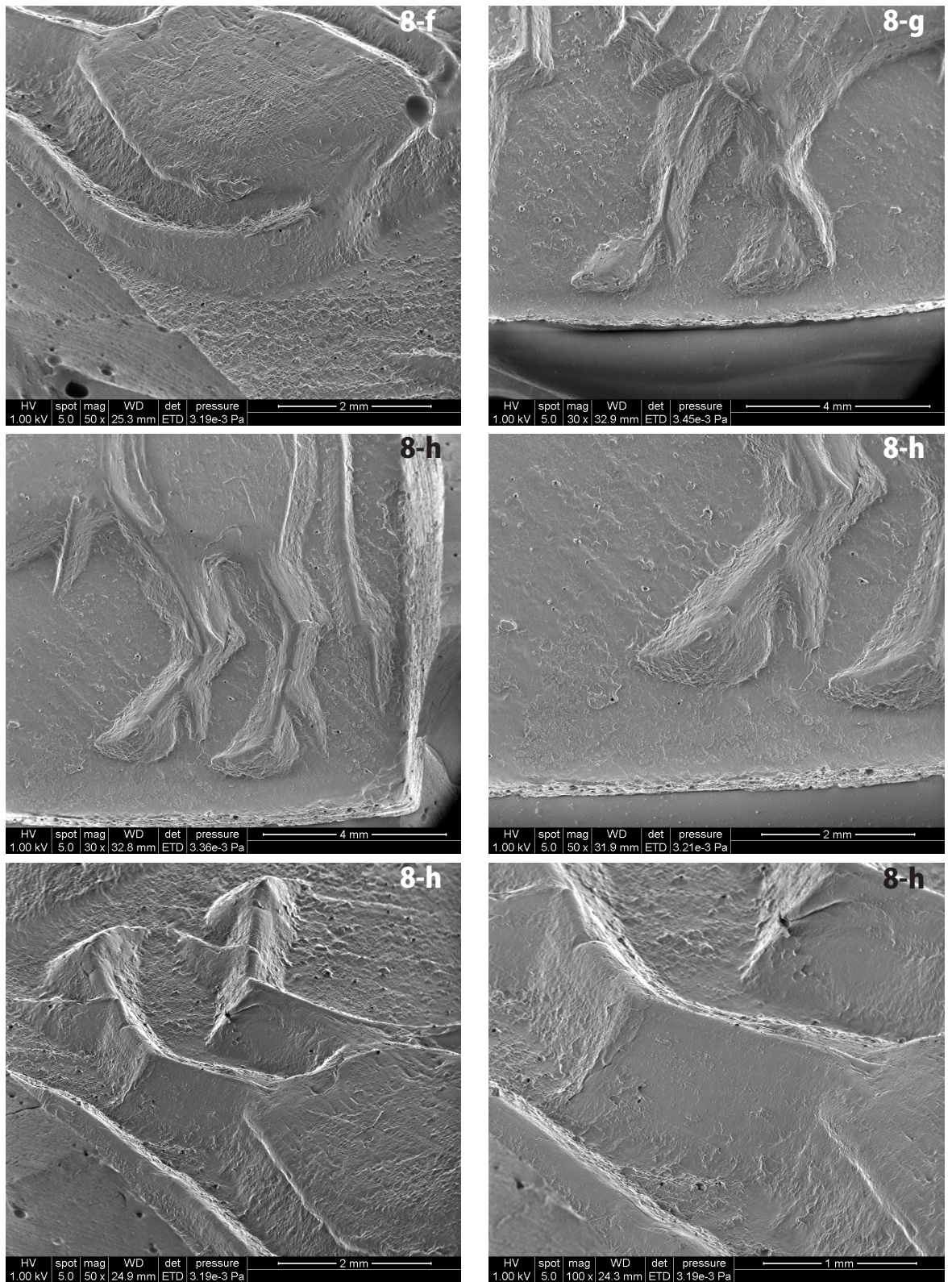


Figure 6.38: SEM images of Harappan seal discovered from the period II of Farmana

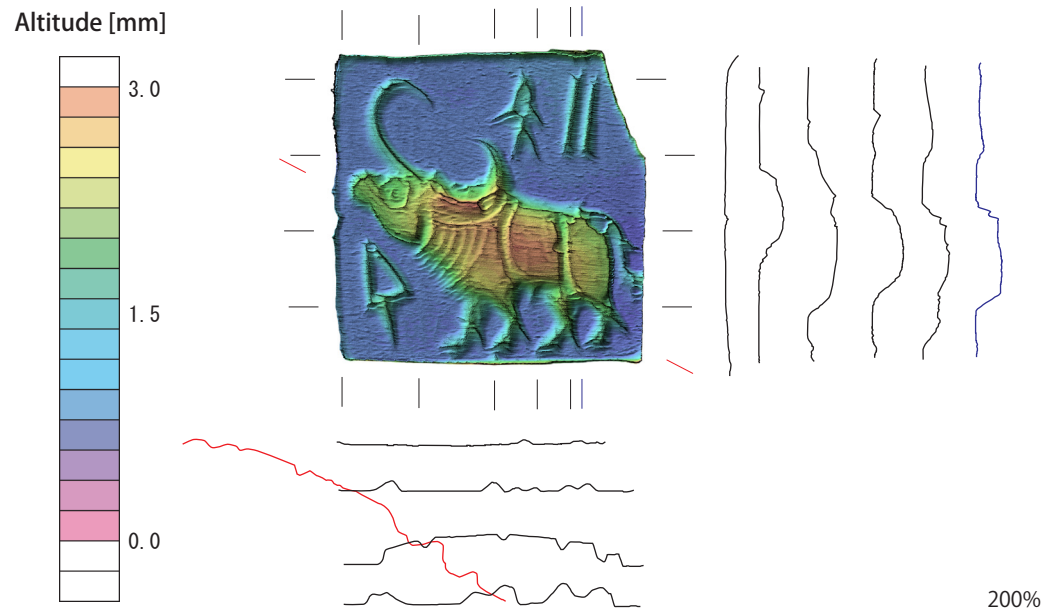


Figure 6.39: Photograph and PEAKIT image of Harappan seal discovered from the period II of Farmana (see also Figure 1.1-4)

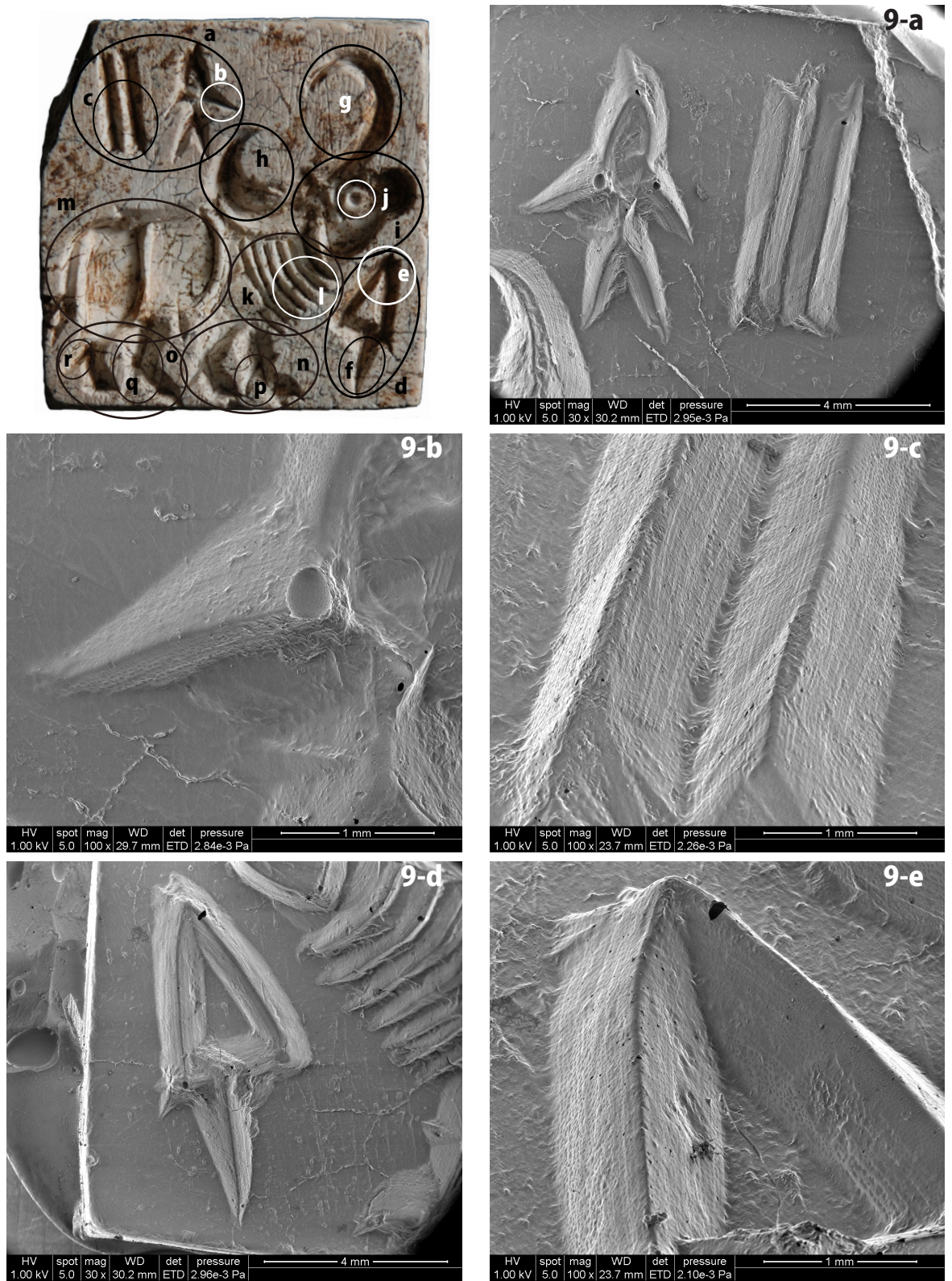


Figure 6.40: Photograph and SEM images of Harappan seal discovered from the period II of Farmana

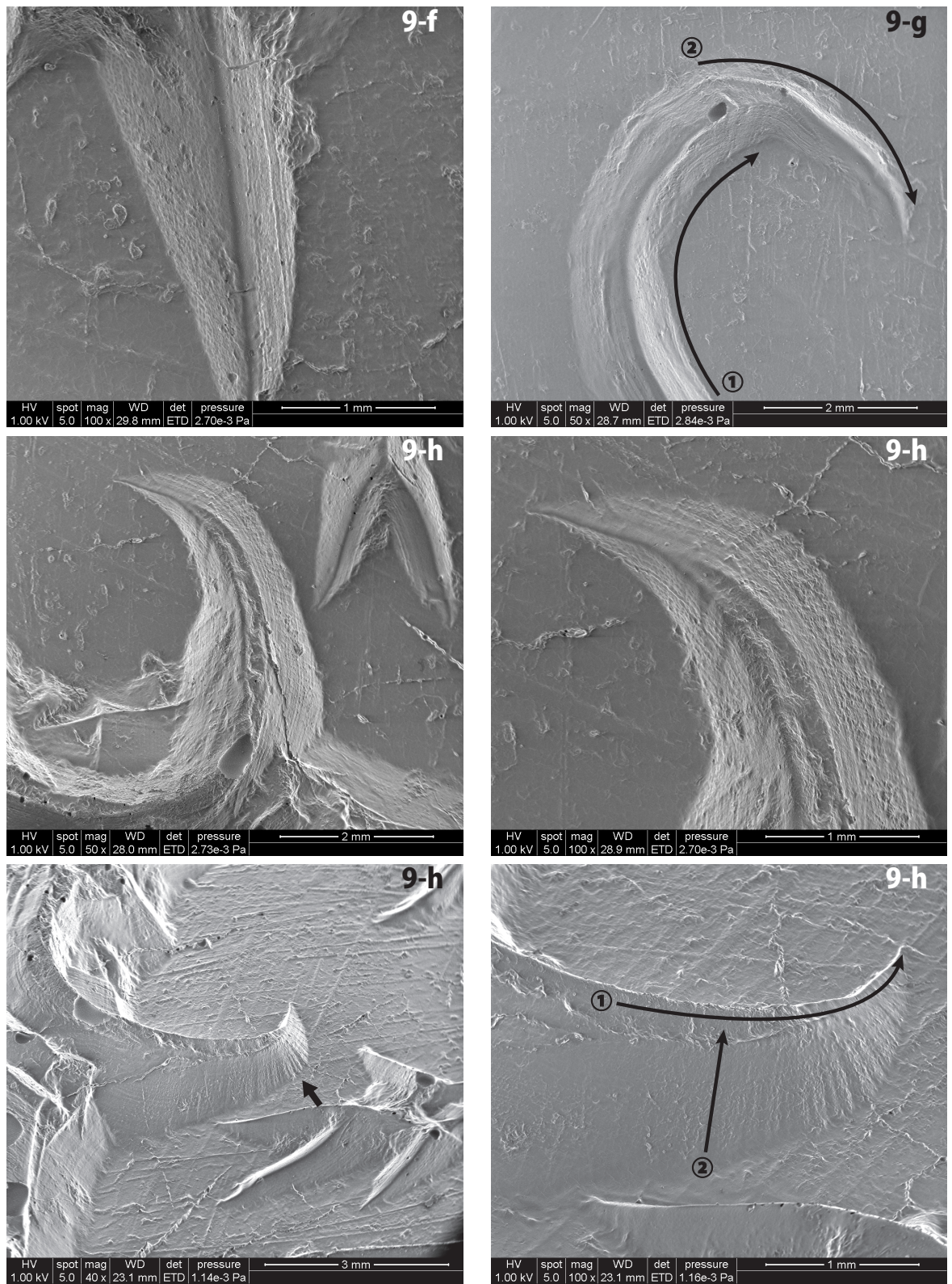


Figure 6.41: SEM images of Harappan seal discovered from the period II of Farmana

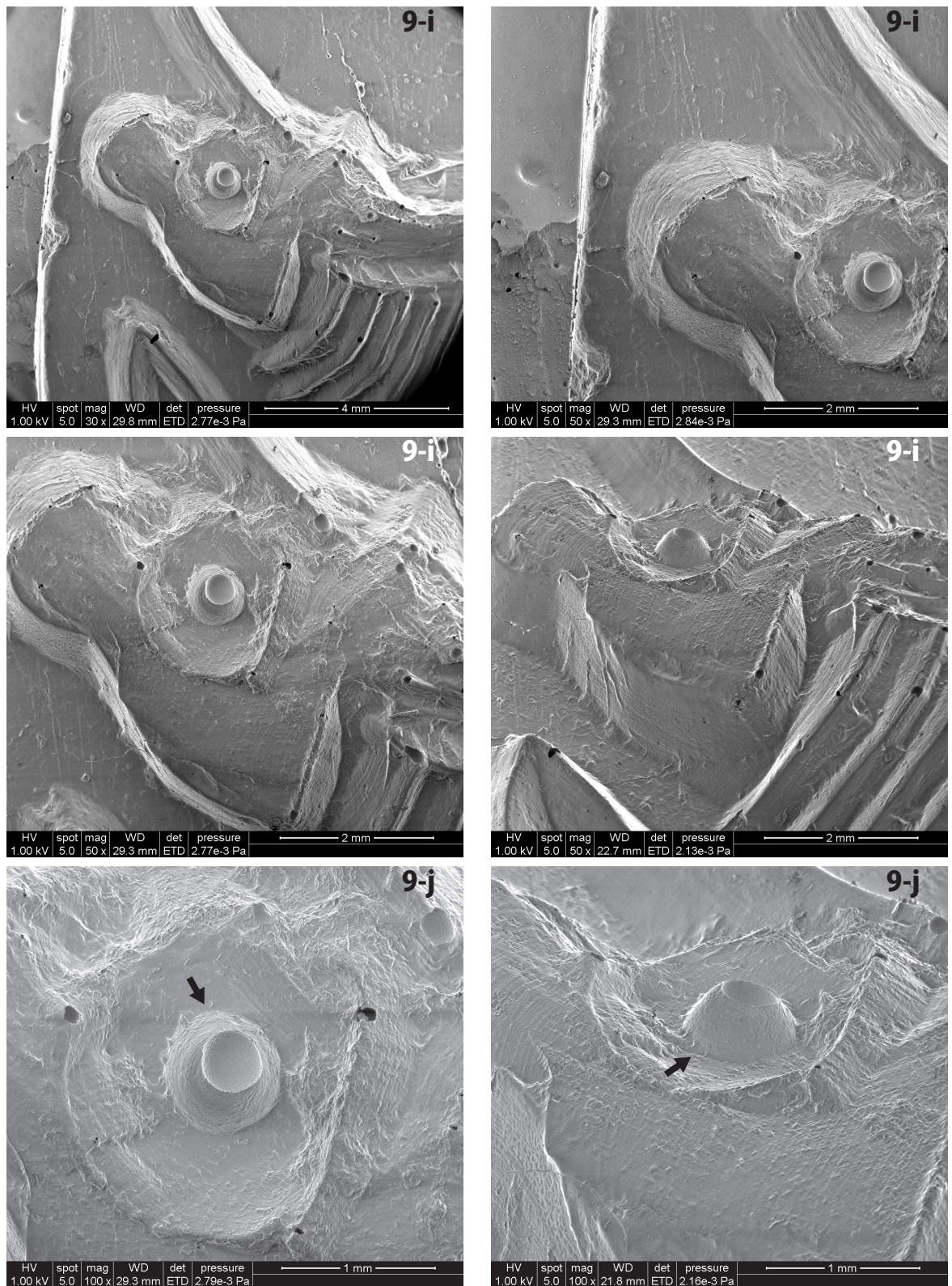


Figure 6.42: SEM images of Harappan seal discovered from the period II of Farmana

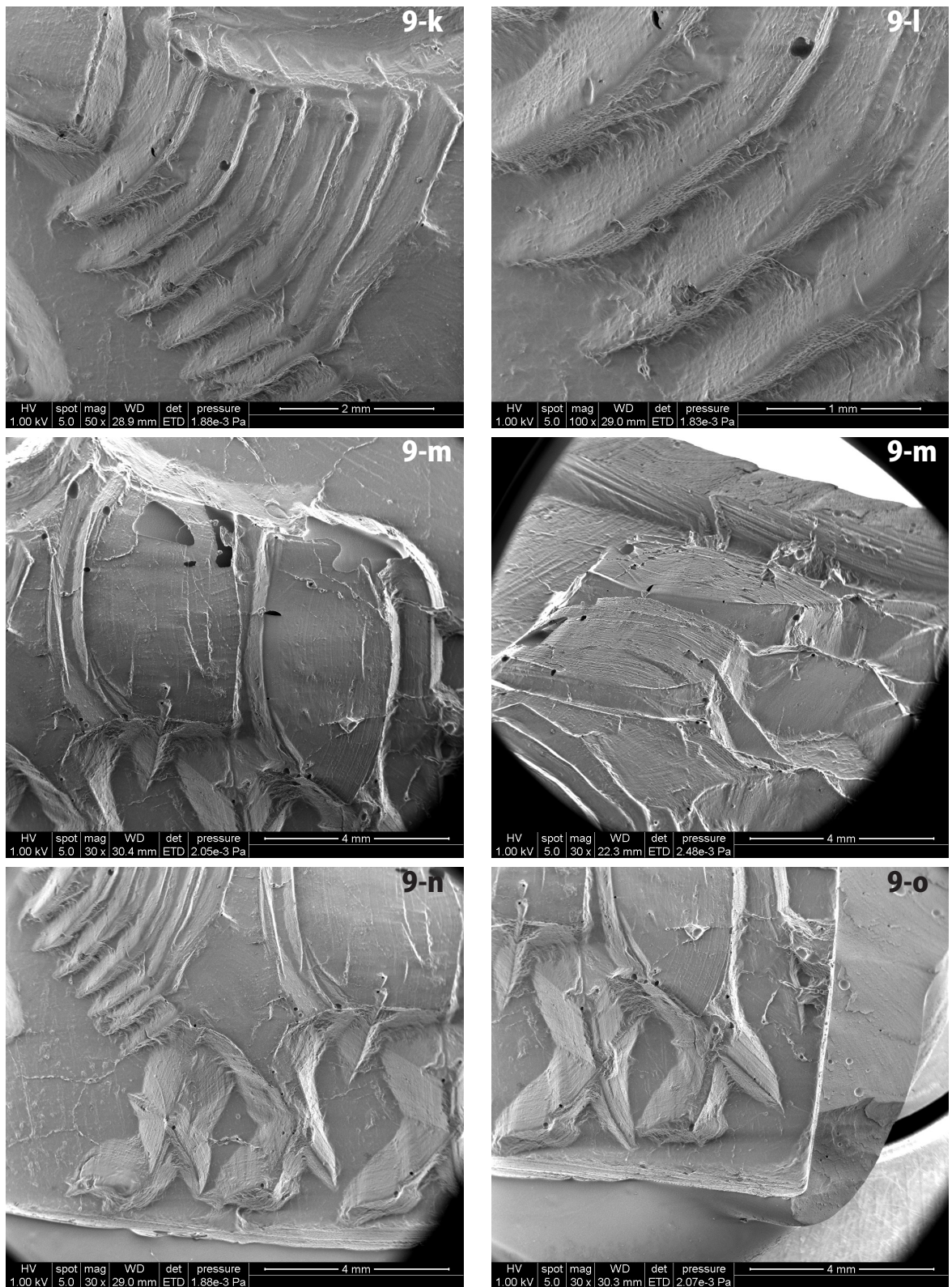


Figure 6.43: SEM images of Harappan seal discovered from the period II of Farmana

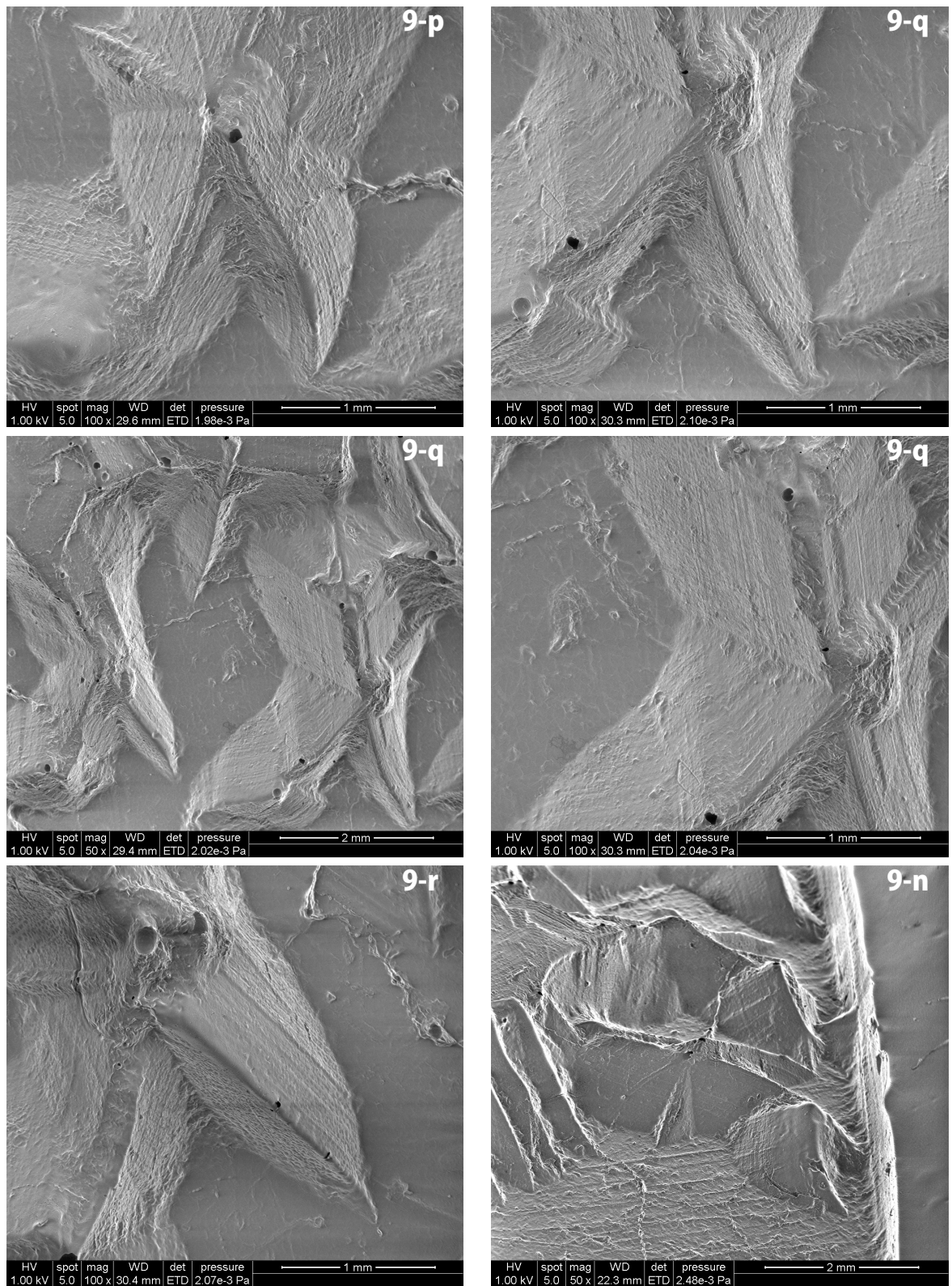
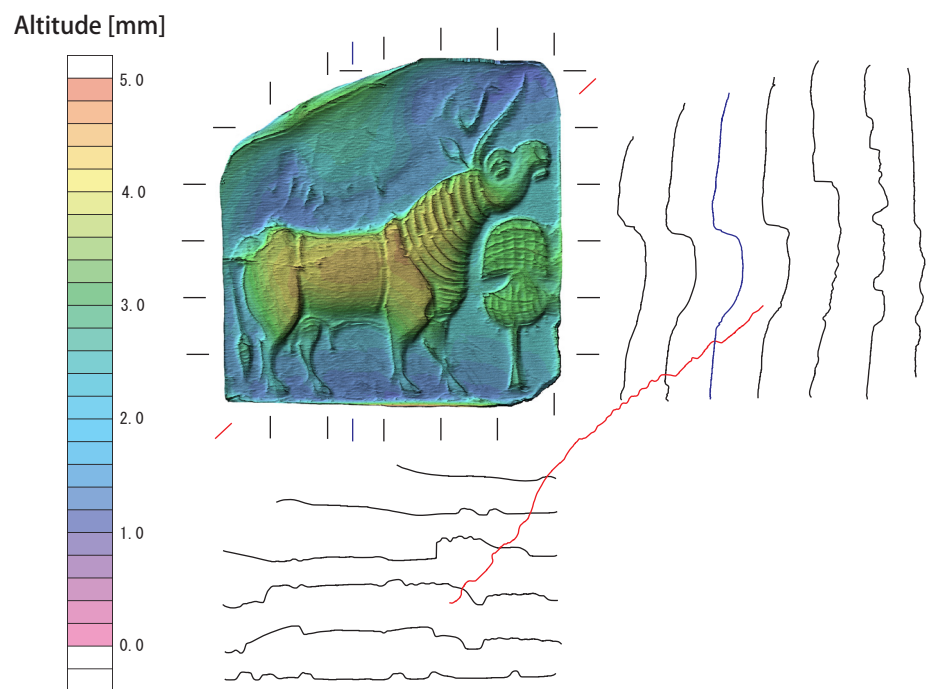


Figure 6.44: SEM images of Harappan seal discovered from the period II of Farmana



125%



150%

Figure 6.45: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.2-1)

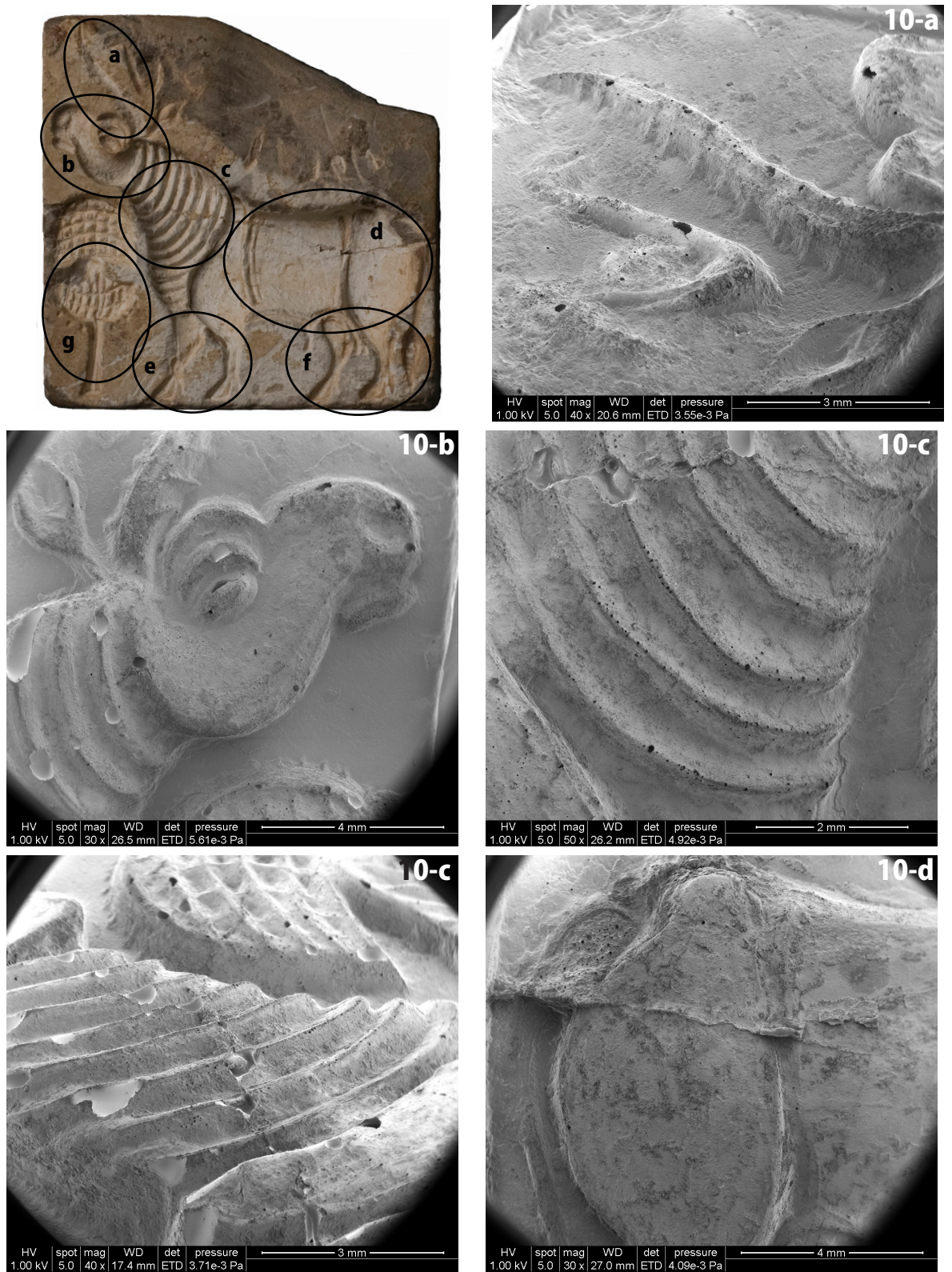


Figure 6.46: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

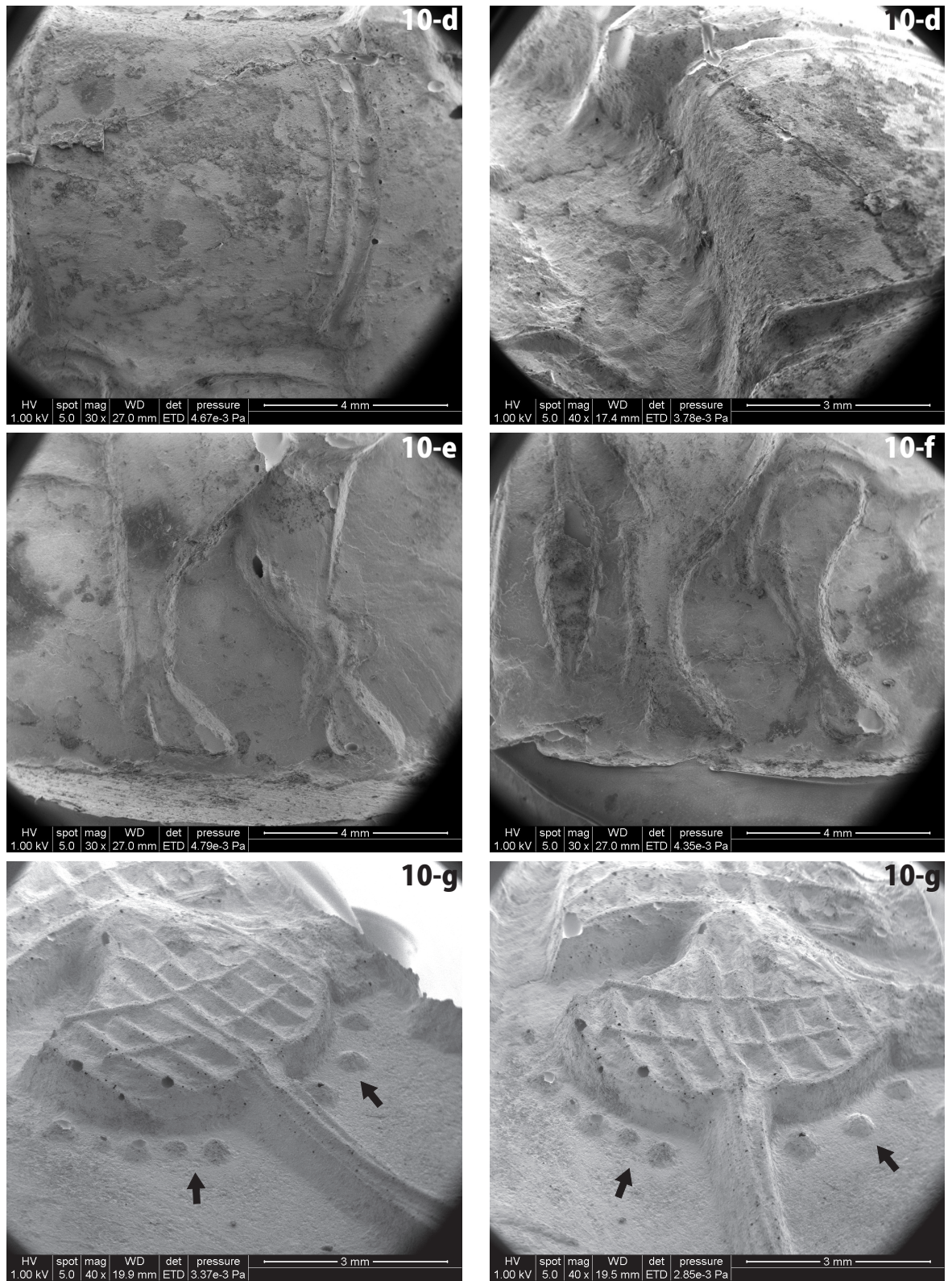


Figure 6.47: SEM images of Harappan seal discovered from the period II of Banawali

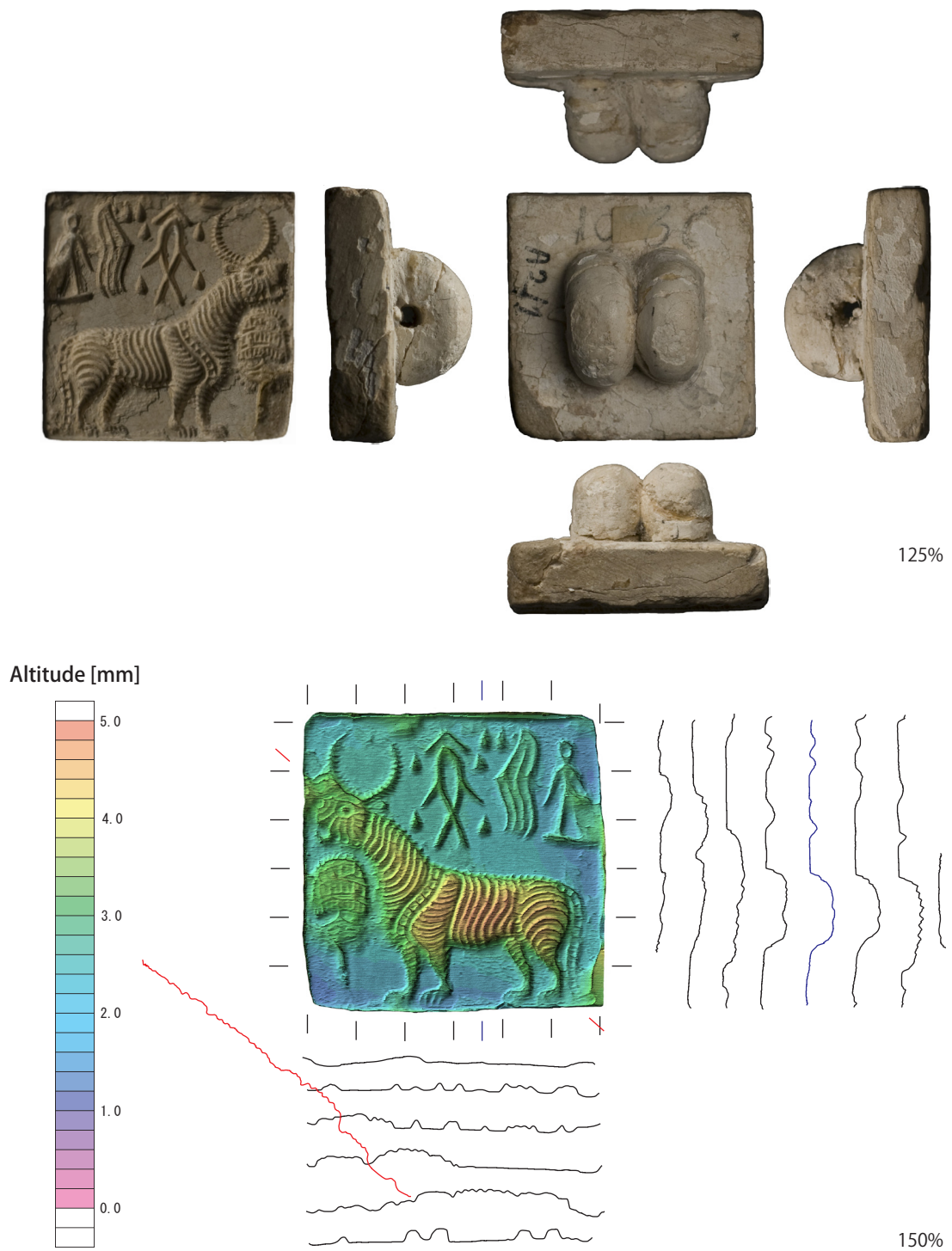


Figure 6.48: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.2-2)

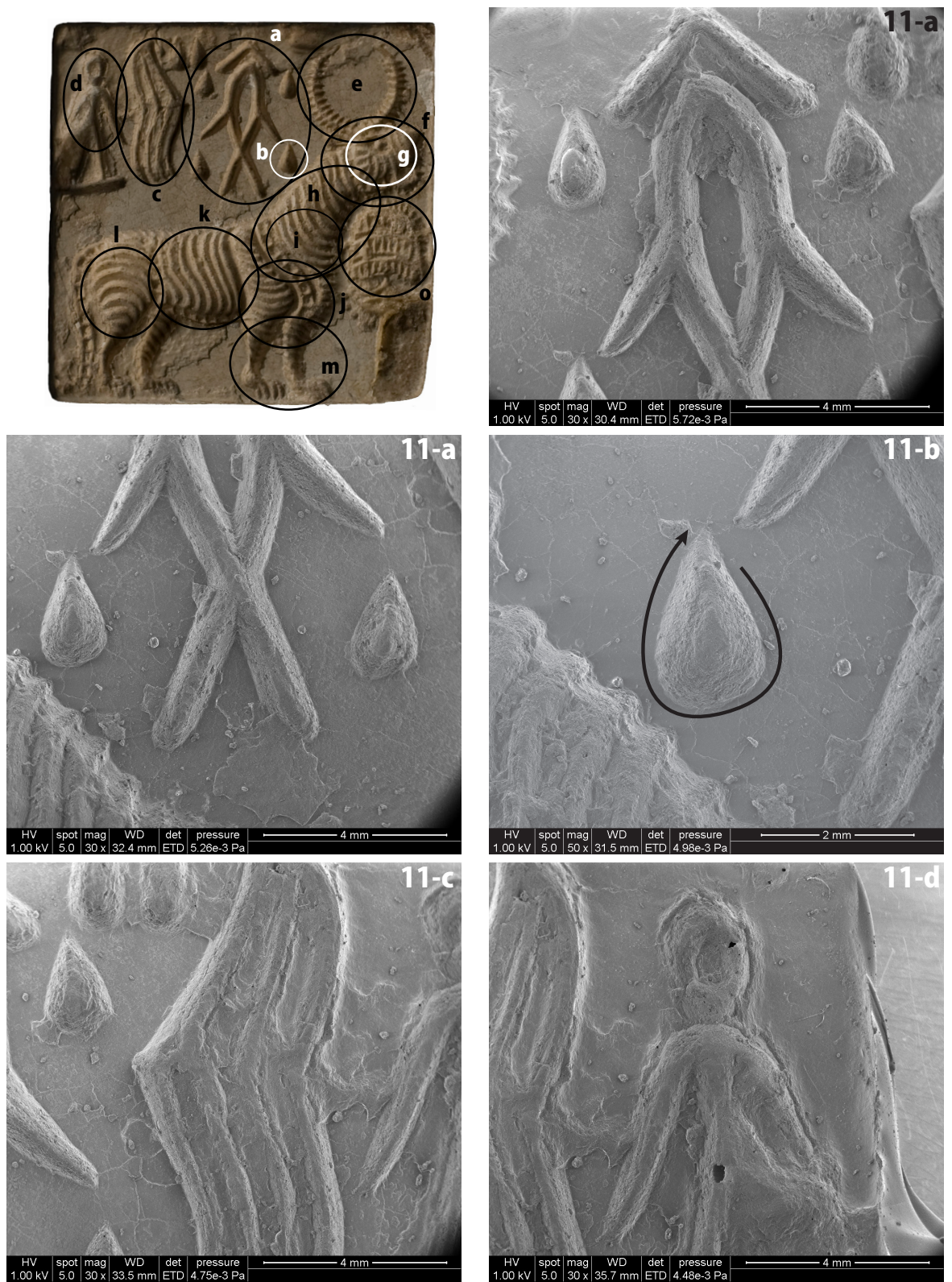


Figure 6.49: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

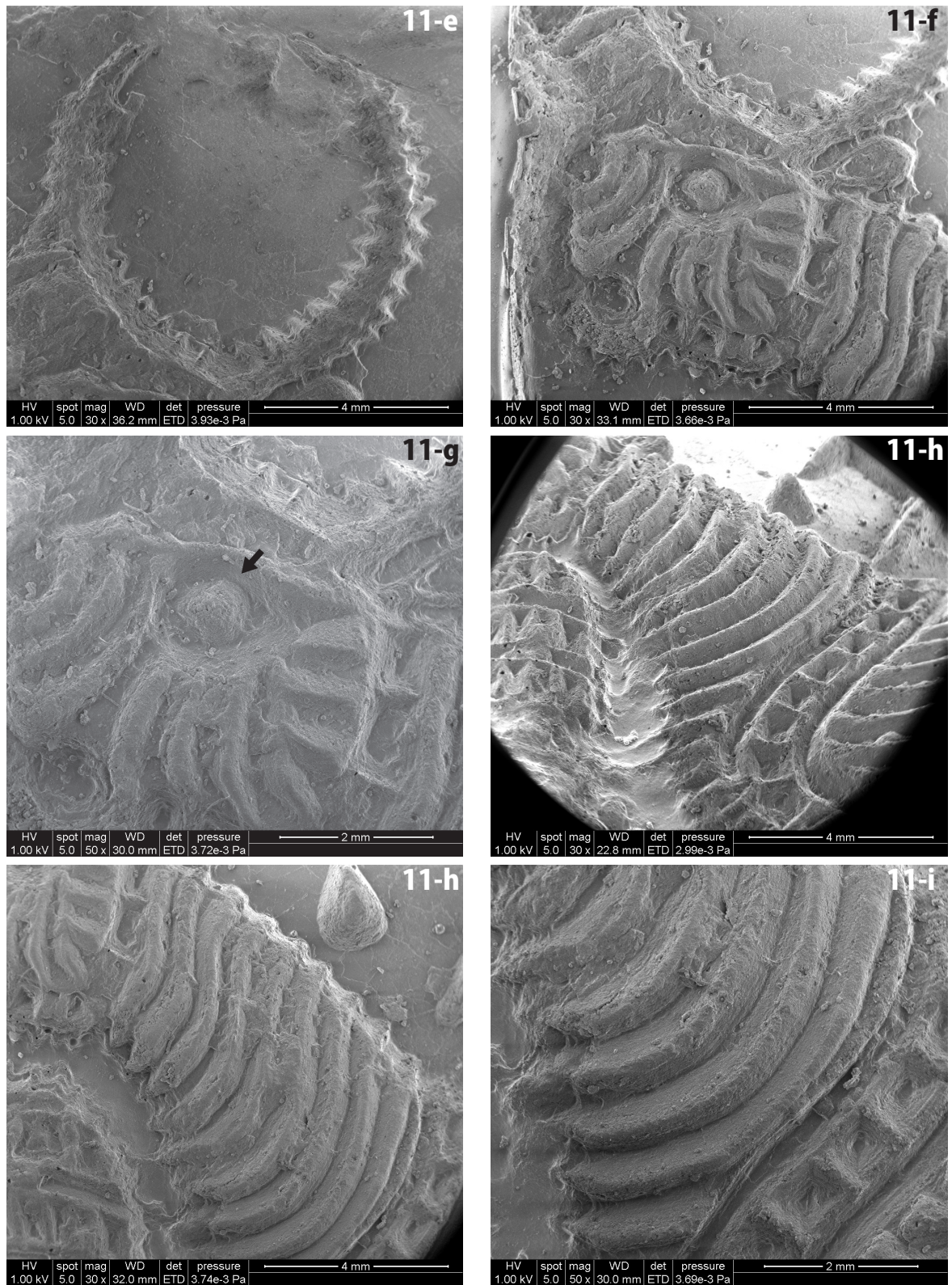


Figure 6.50: SEM images of Harappan seal discovered from the period II of Banawali

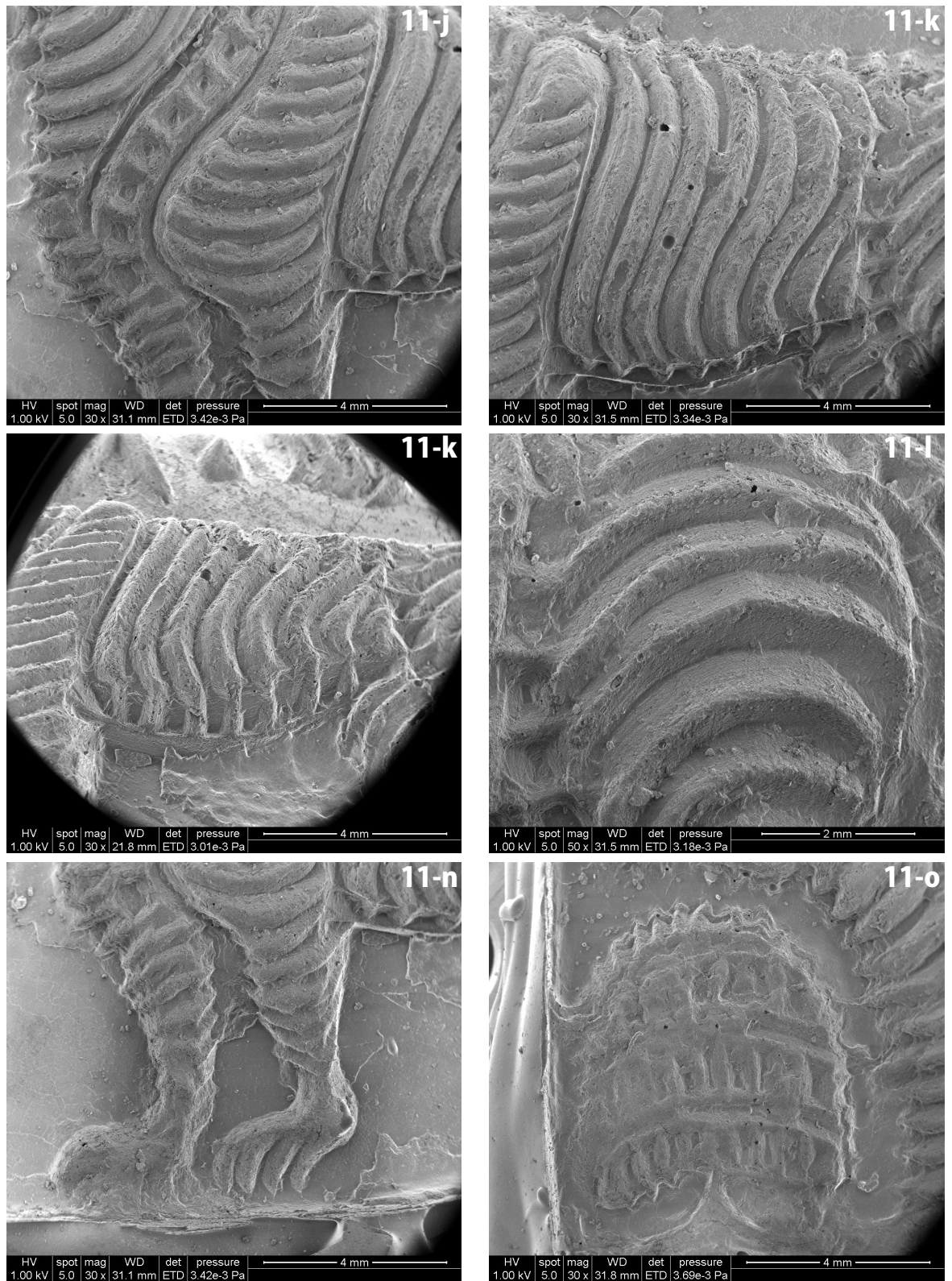


Figure 6.51: SEM images of Harappan seal discovered from the period II of Banawali

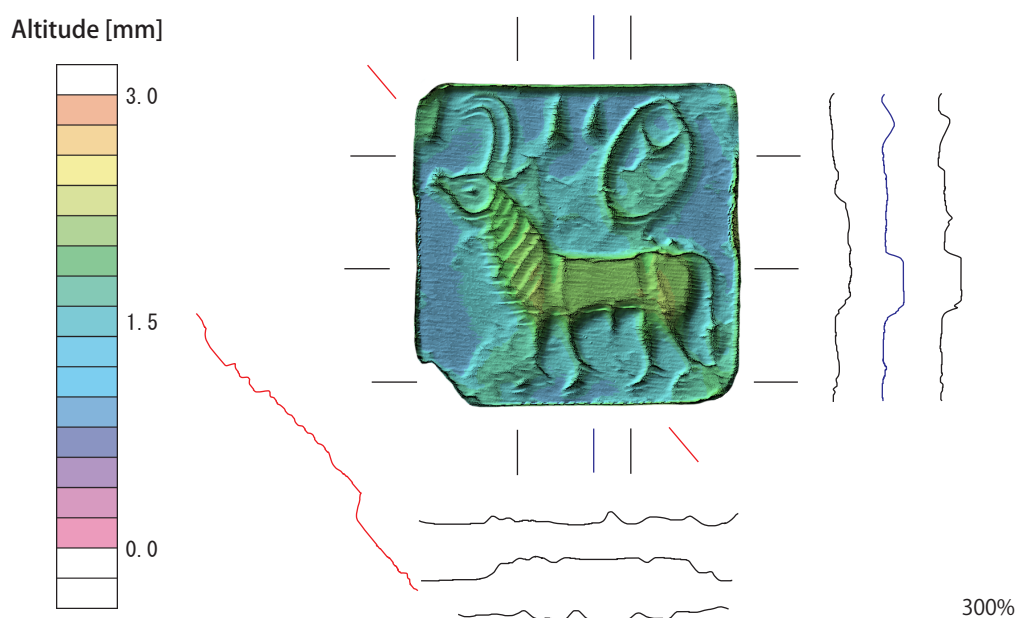


Figure 6.52: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-5)

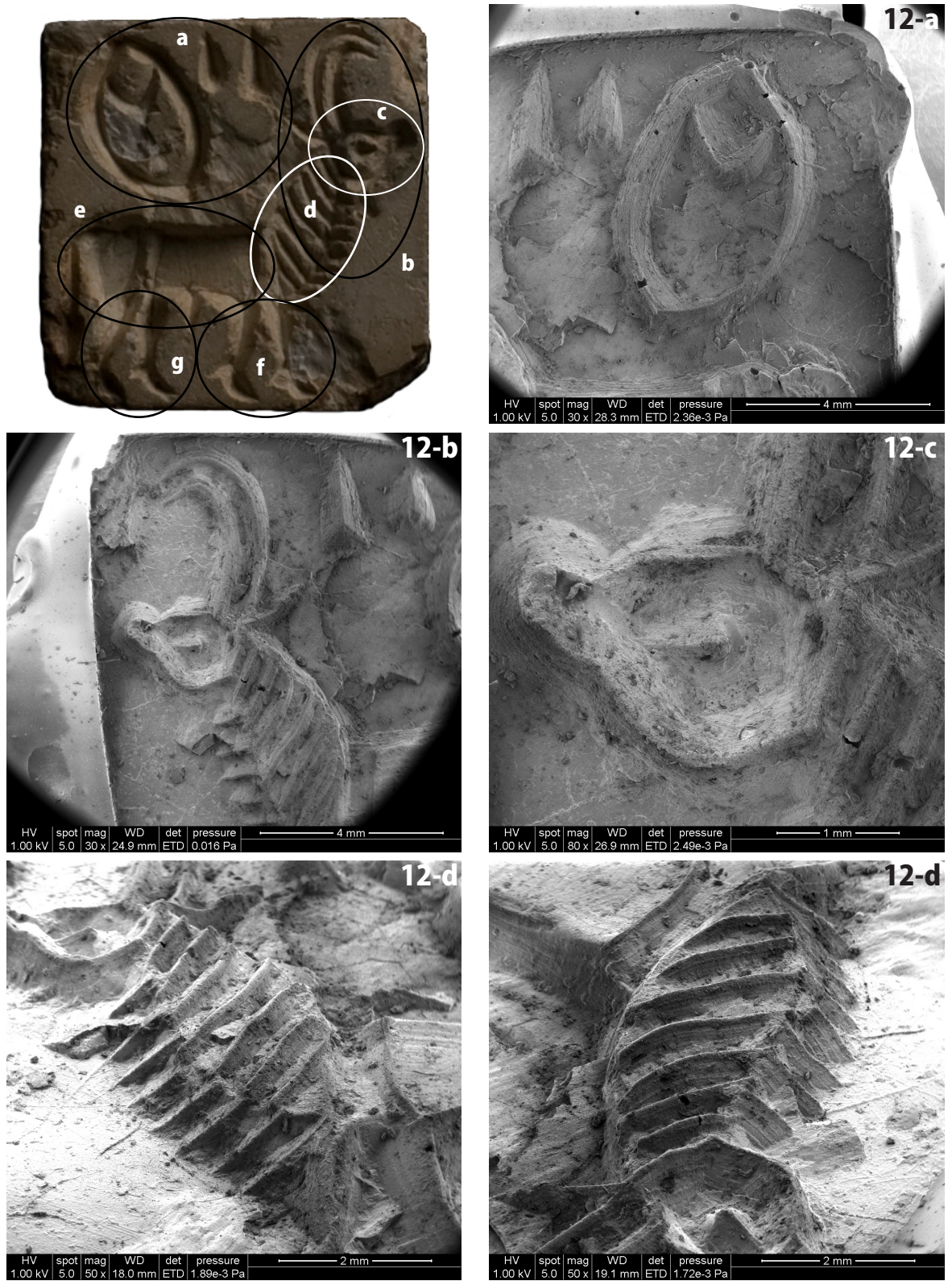


Figure 6.53: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

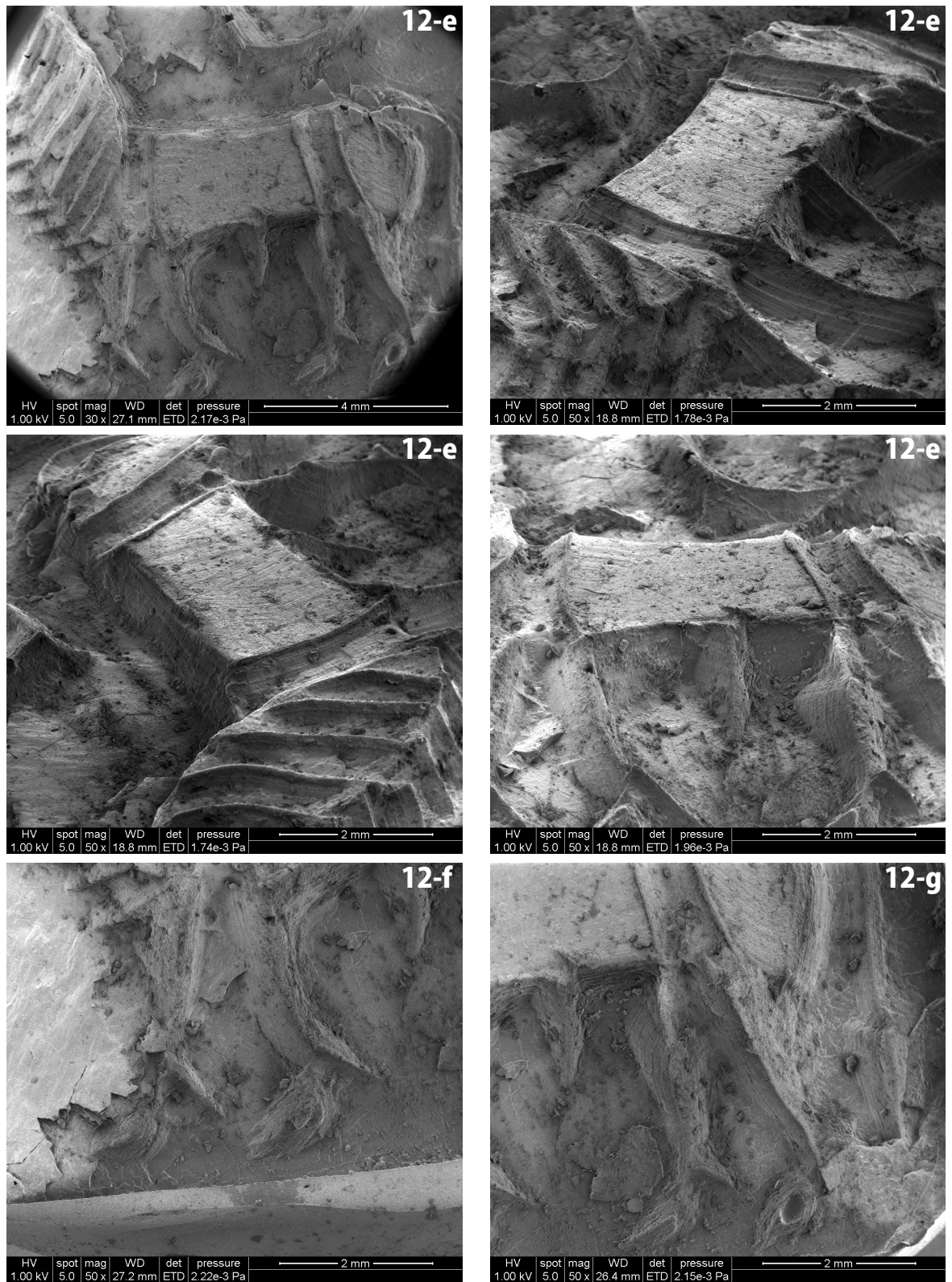


Figure 6.54: SEM images of Harappan seal discovered from the period II of Banawali

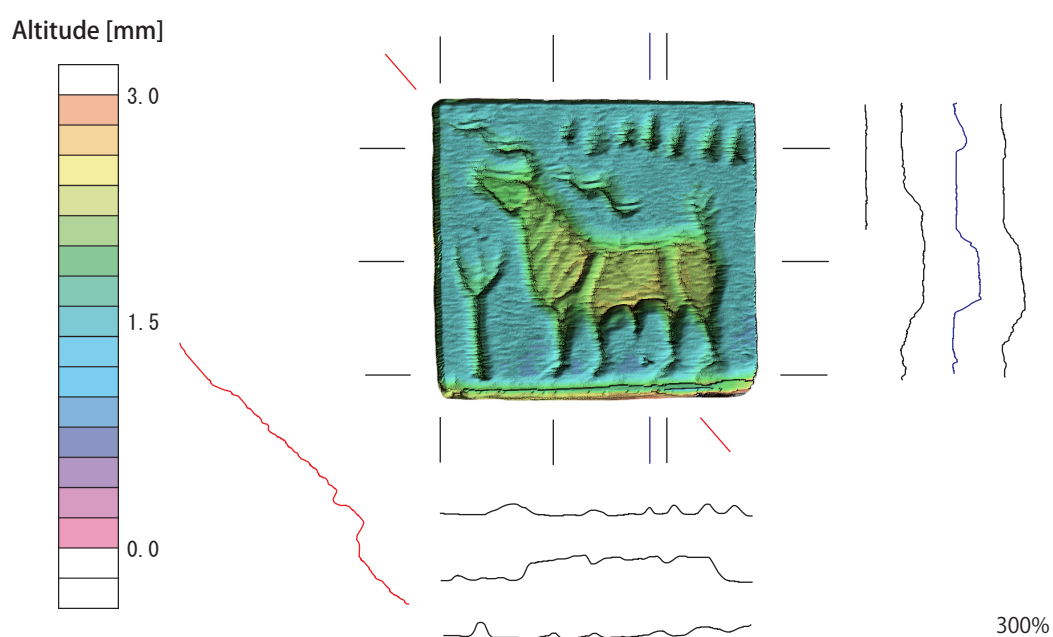


Figure 6.55: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-4)

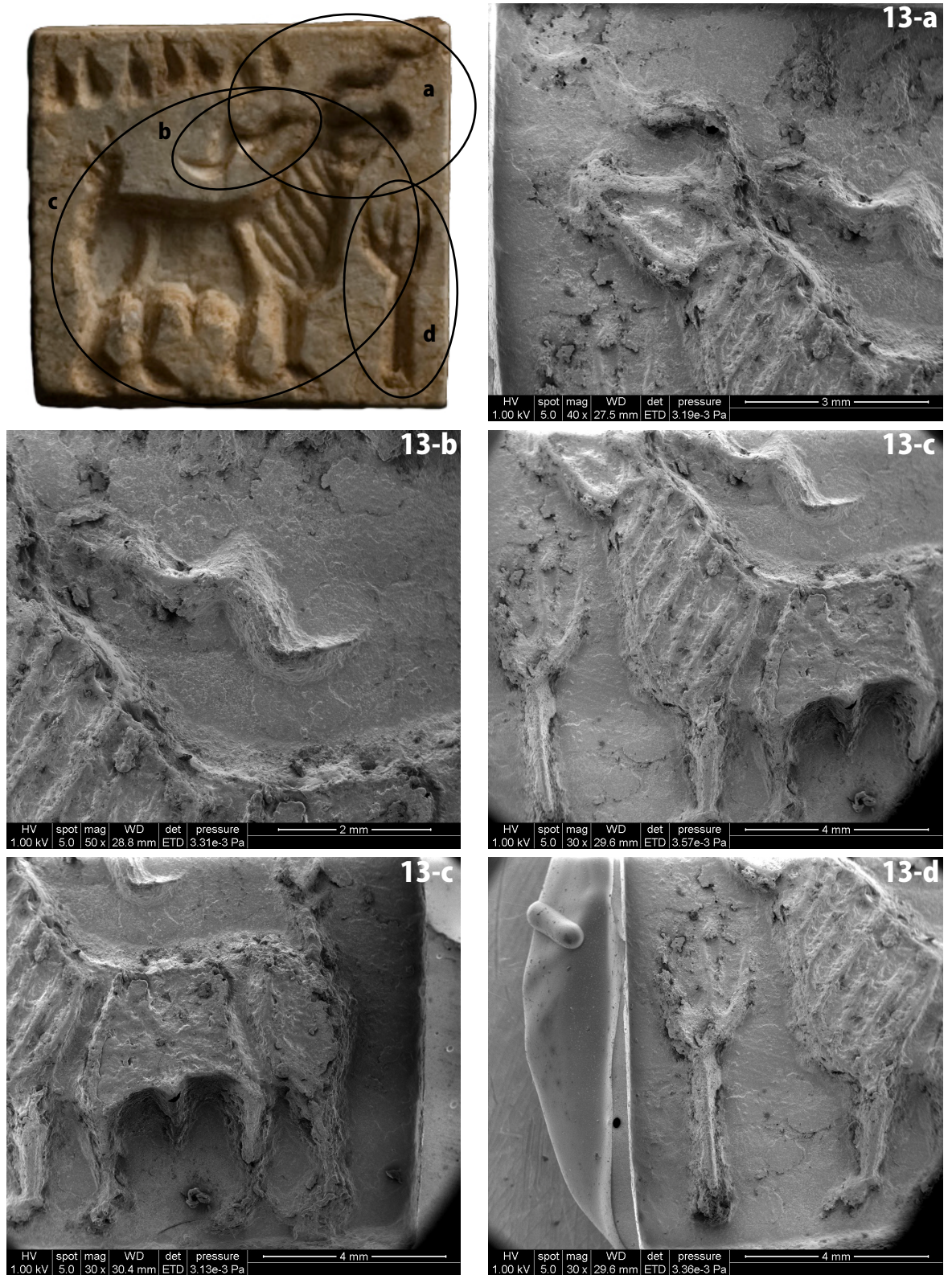
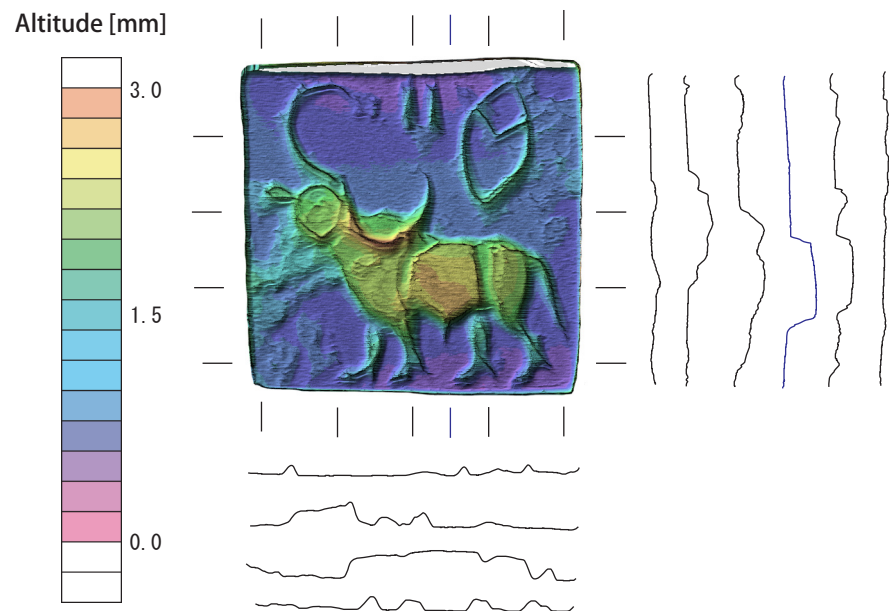


Figure 6.56: Photograph and SEM images of Harappan seal discovered from the period II of Banawali



200%



200%

Figure 6.57: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-1)

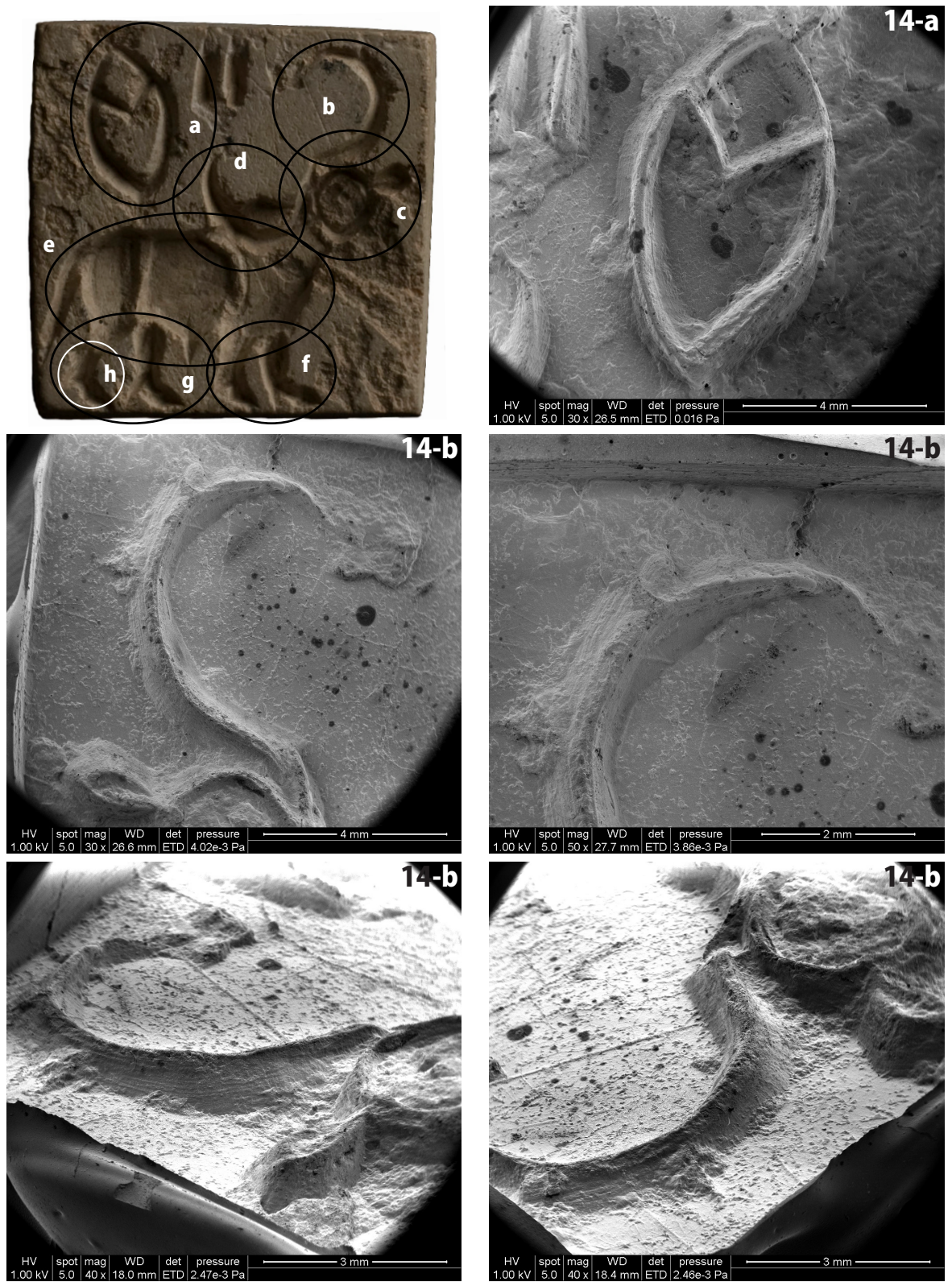


Figure 6.58: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

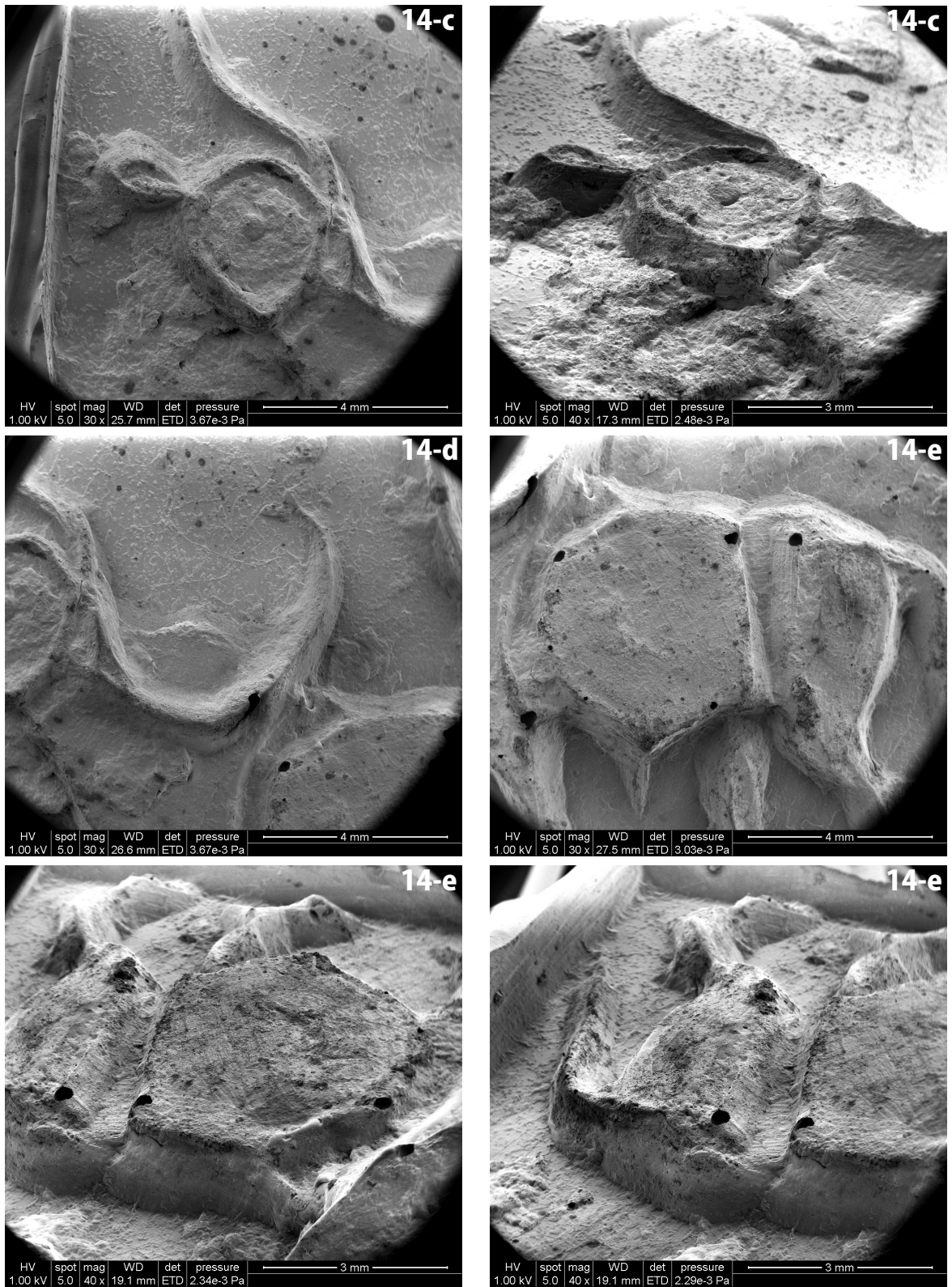


Figure 6.59: SEM images of Harappan seal discovered from the period II of Banawali

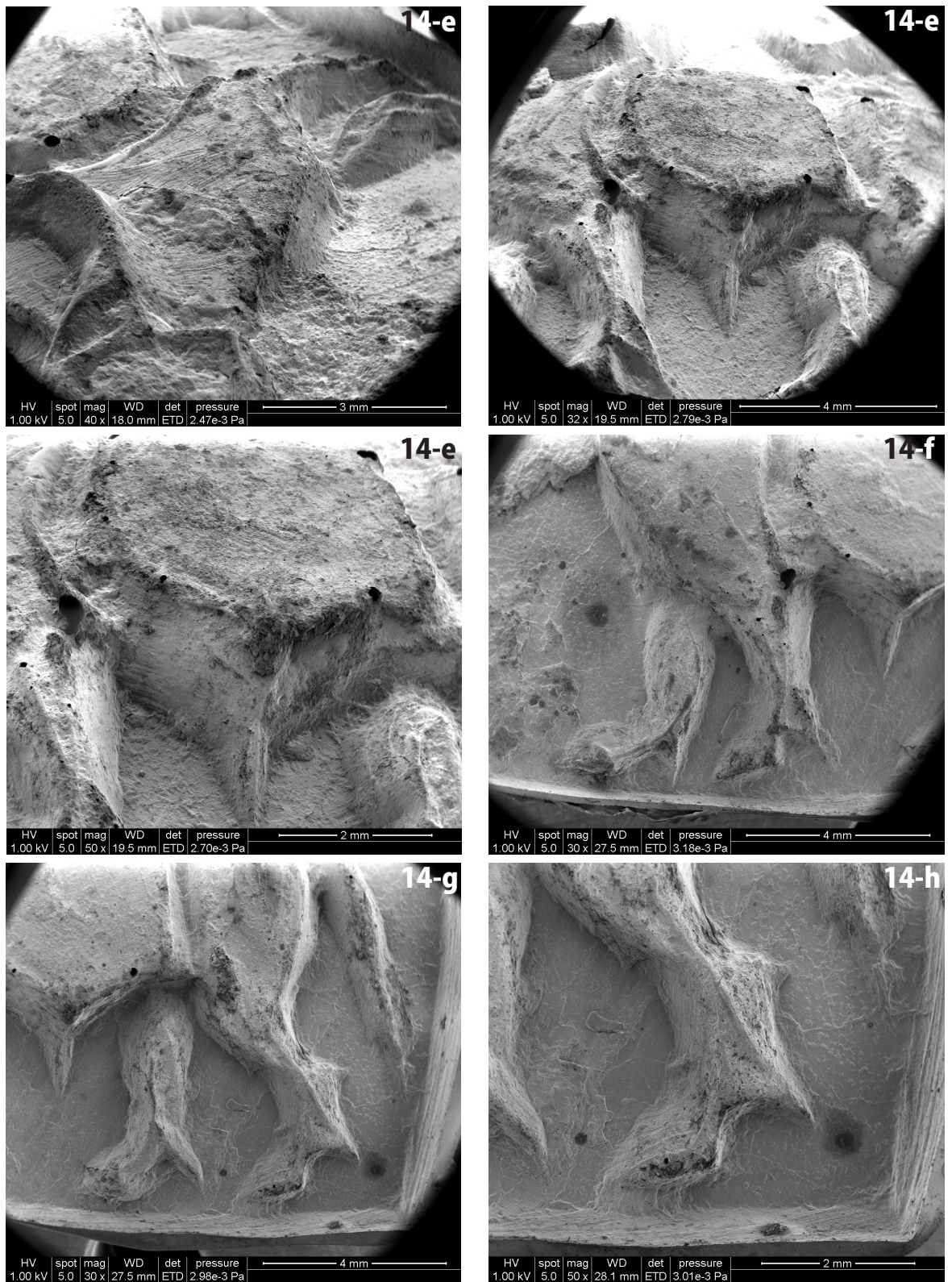


Figure 6.60: SEM images of Harappan seal discovered from the period II of Banawali

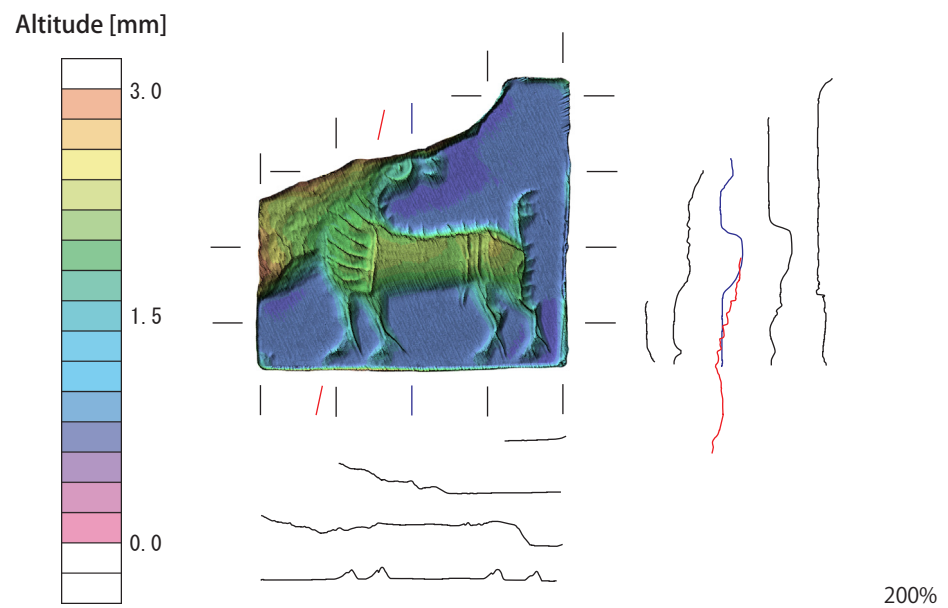


Figure 6.61: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-3)

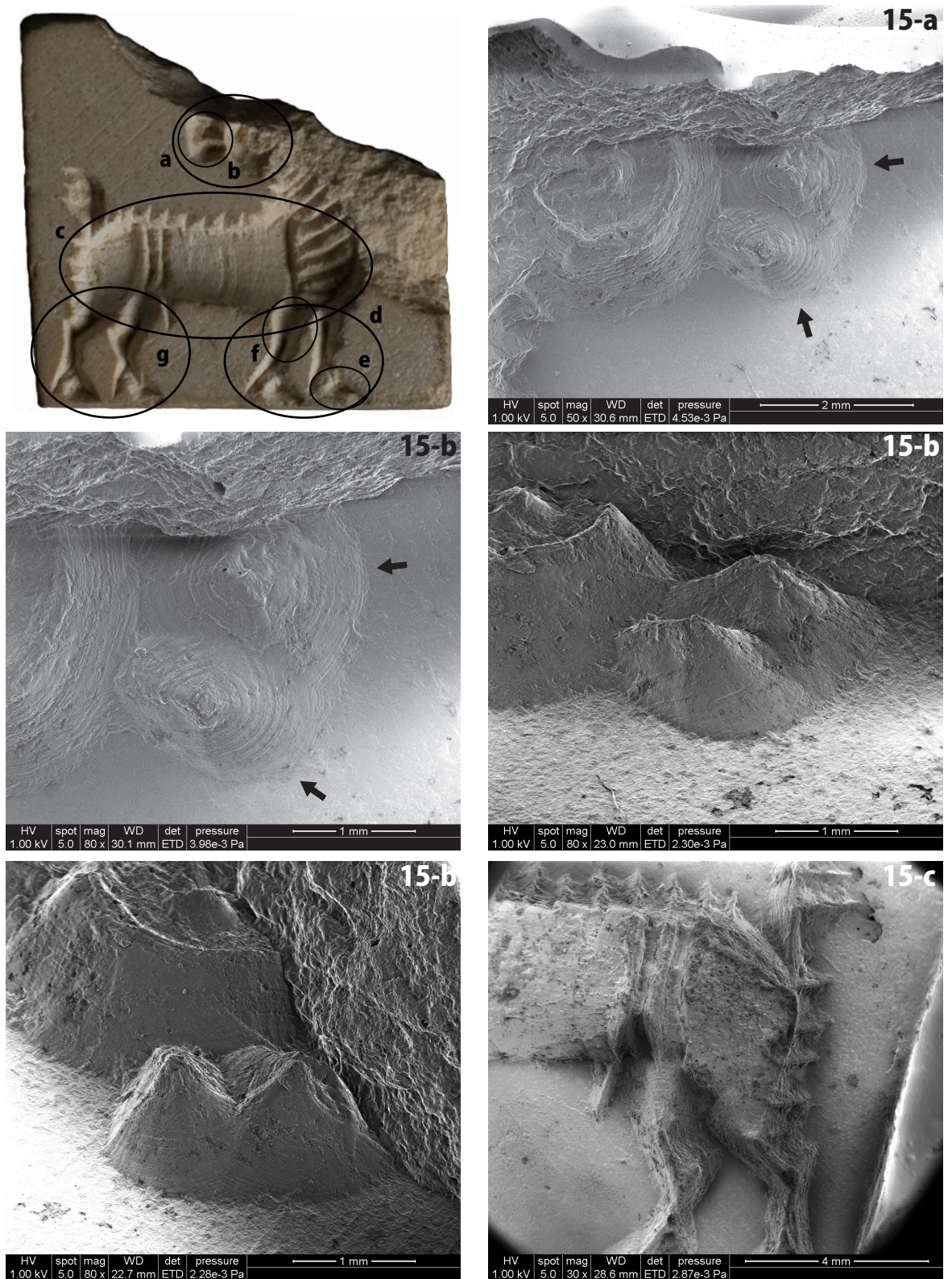


Figure 6.62: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

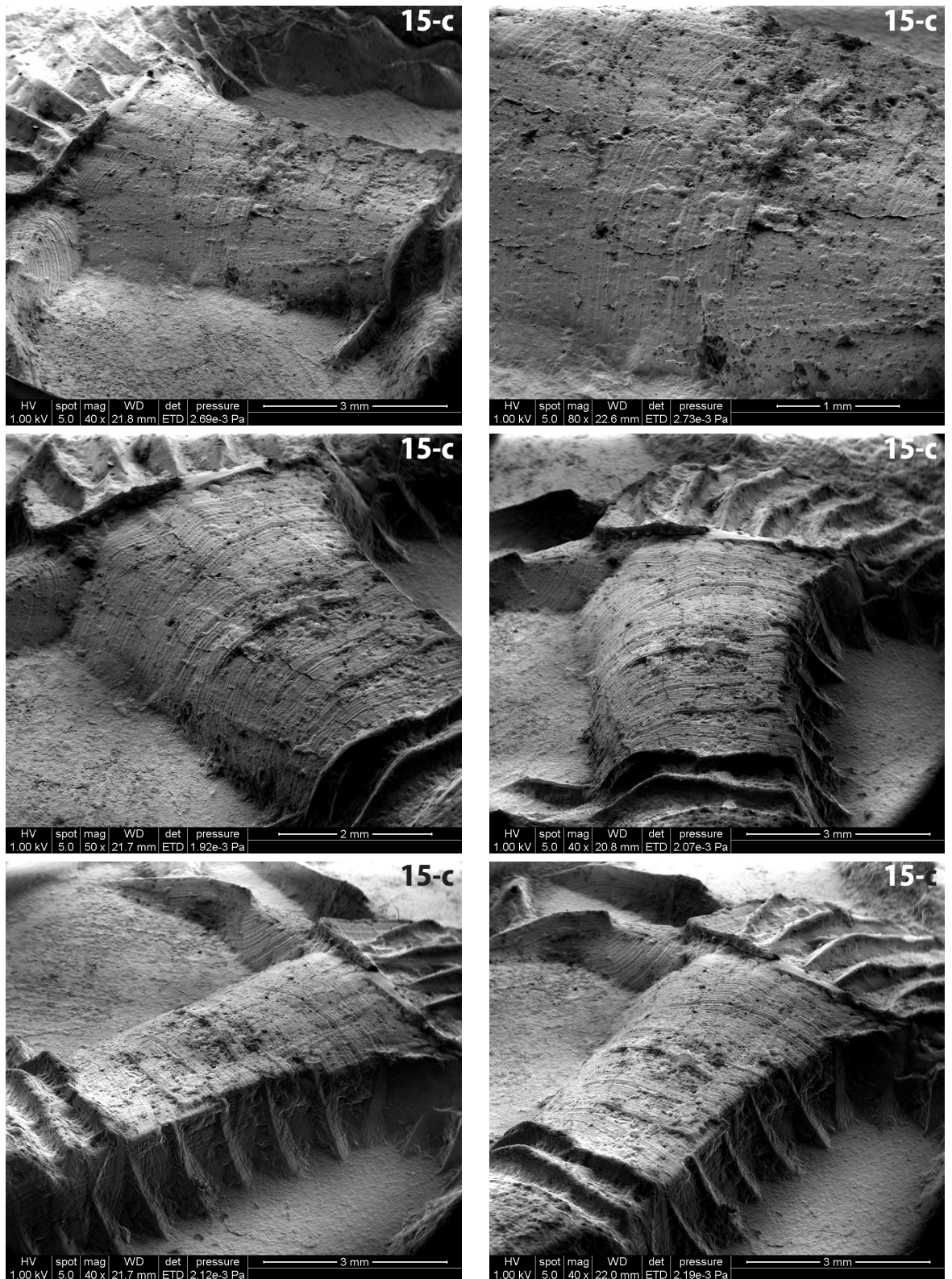


Figure 6.63: SEM images of Harappan seal discovered from the period II of Banawali

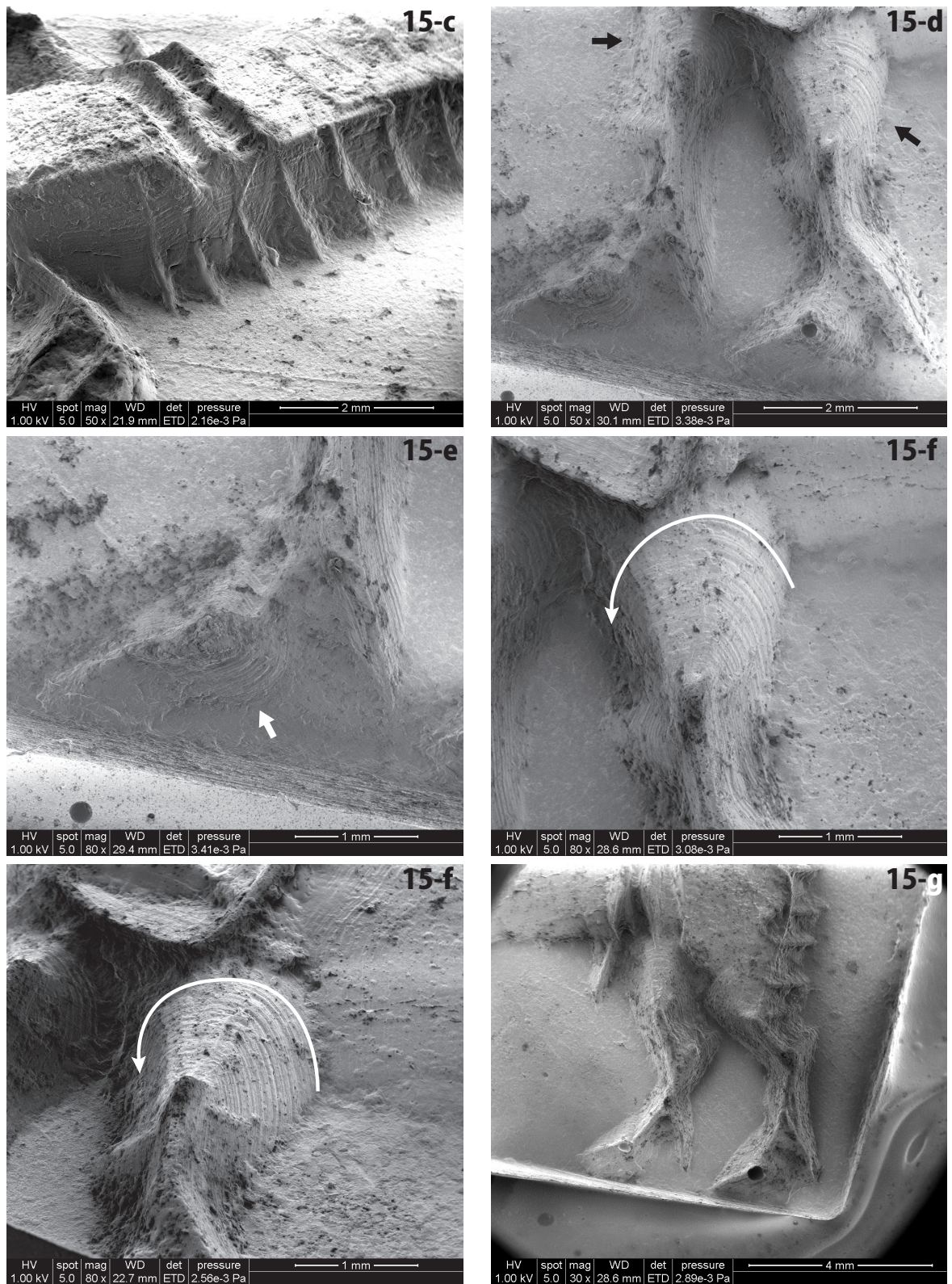
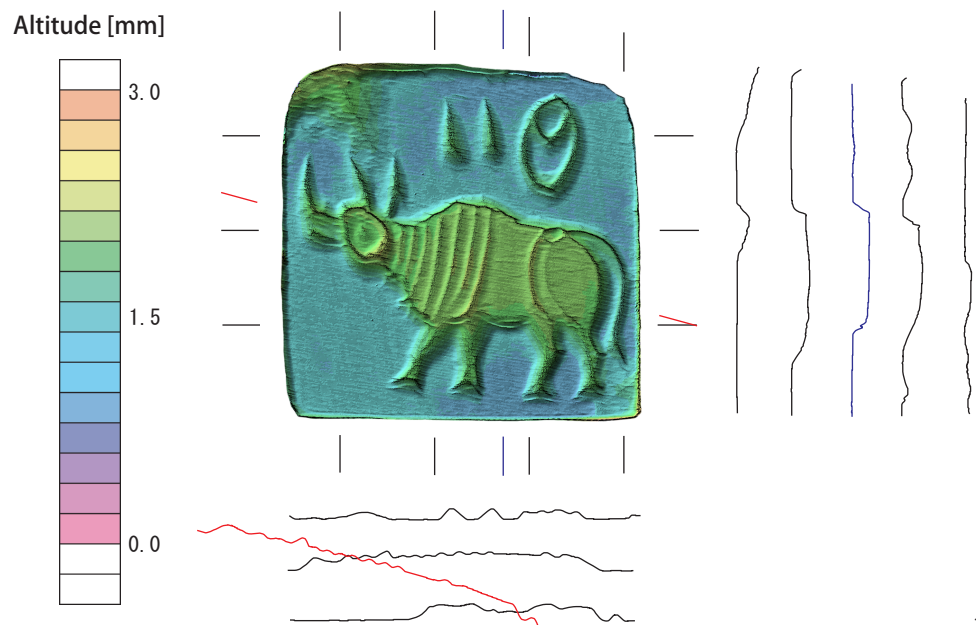


Figure 6.64: SEM images of Harappan seal discovered from the period II of Banawali



200%



250%

Figure 6.65: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-2)

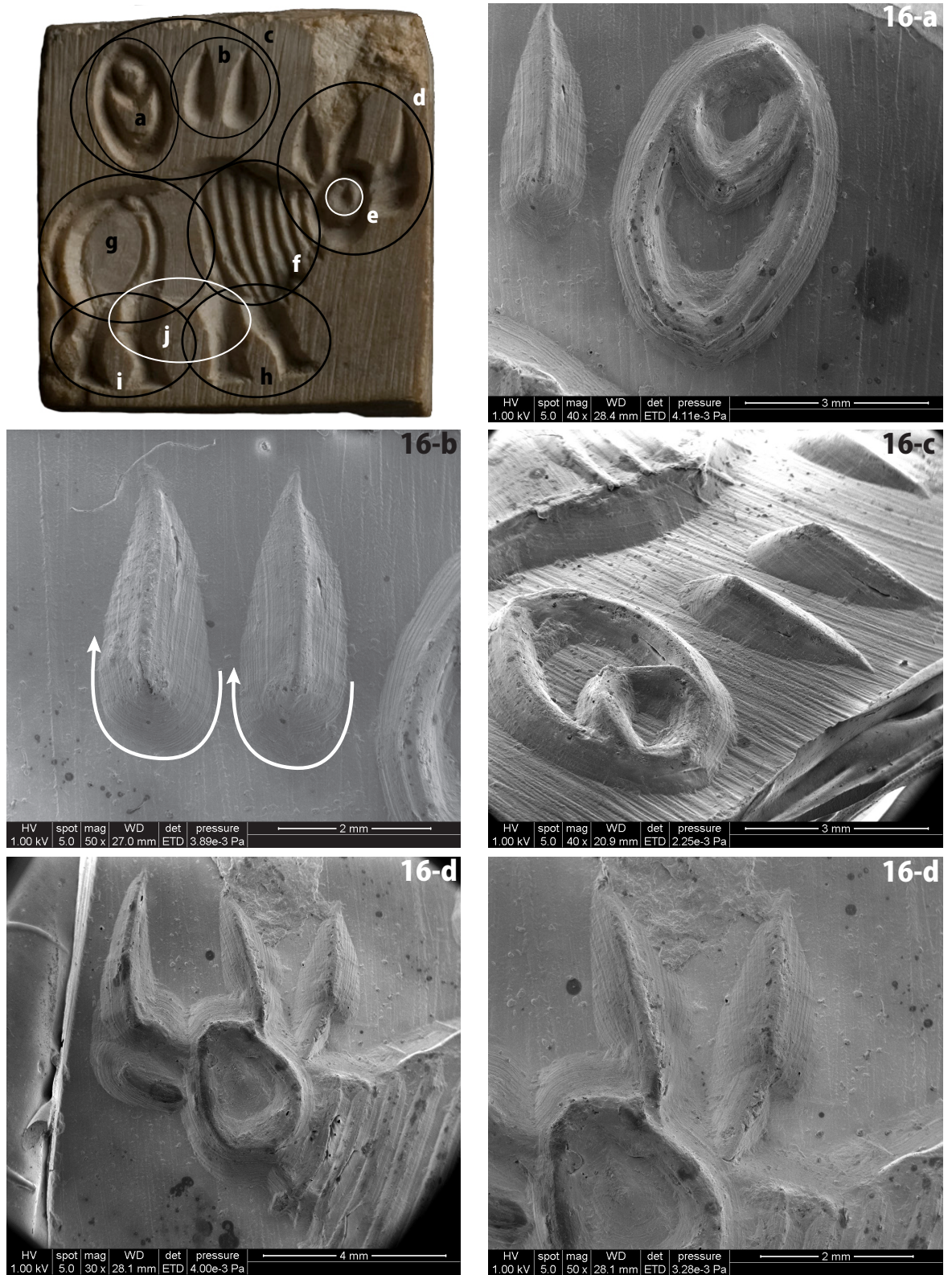


Figure 6.66: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

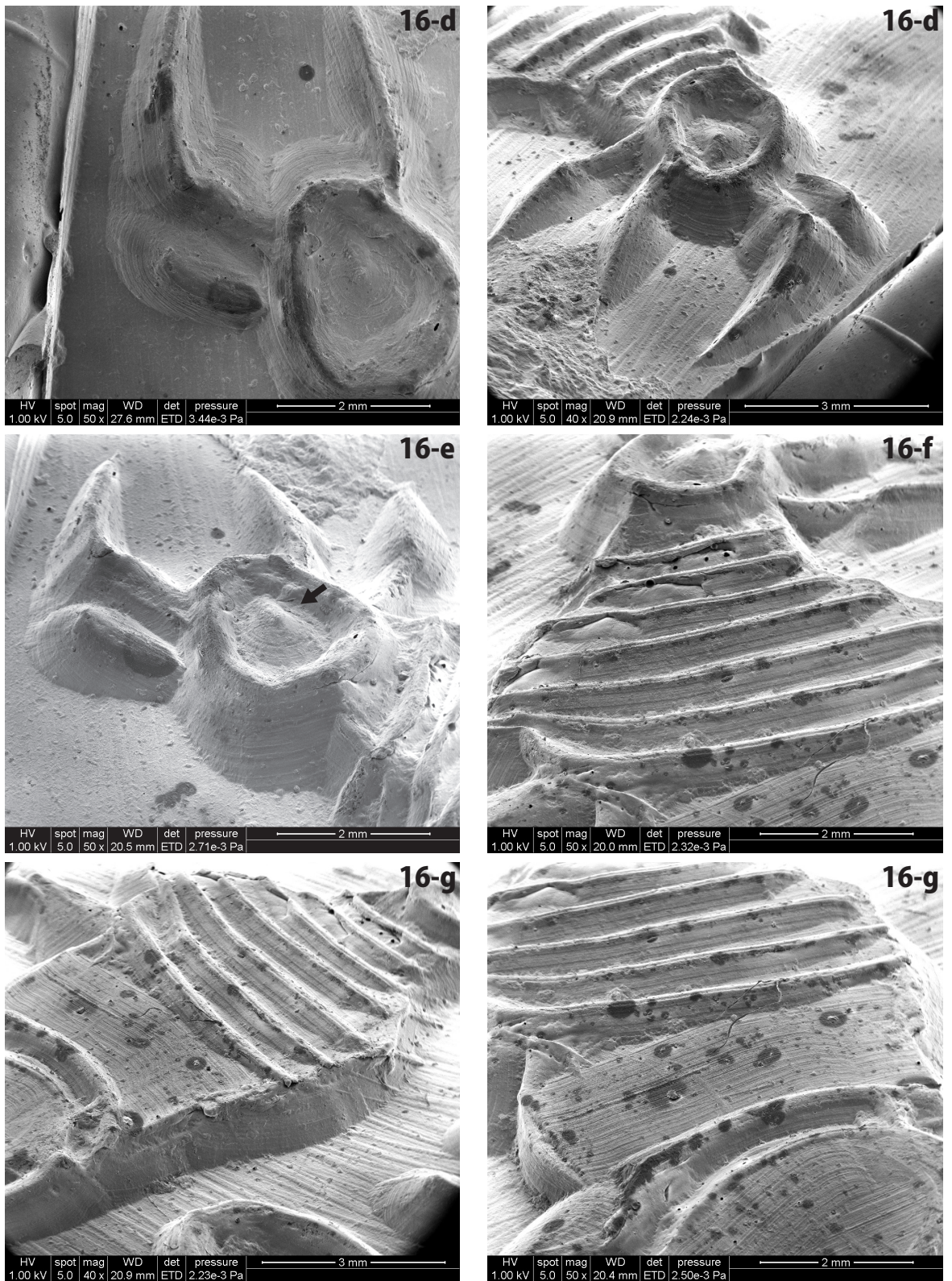


Figure 6.67: SEM images of Harappan seal discovered from the period II of Banawali

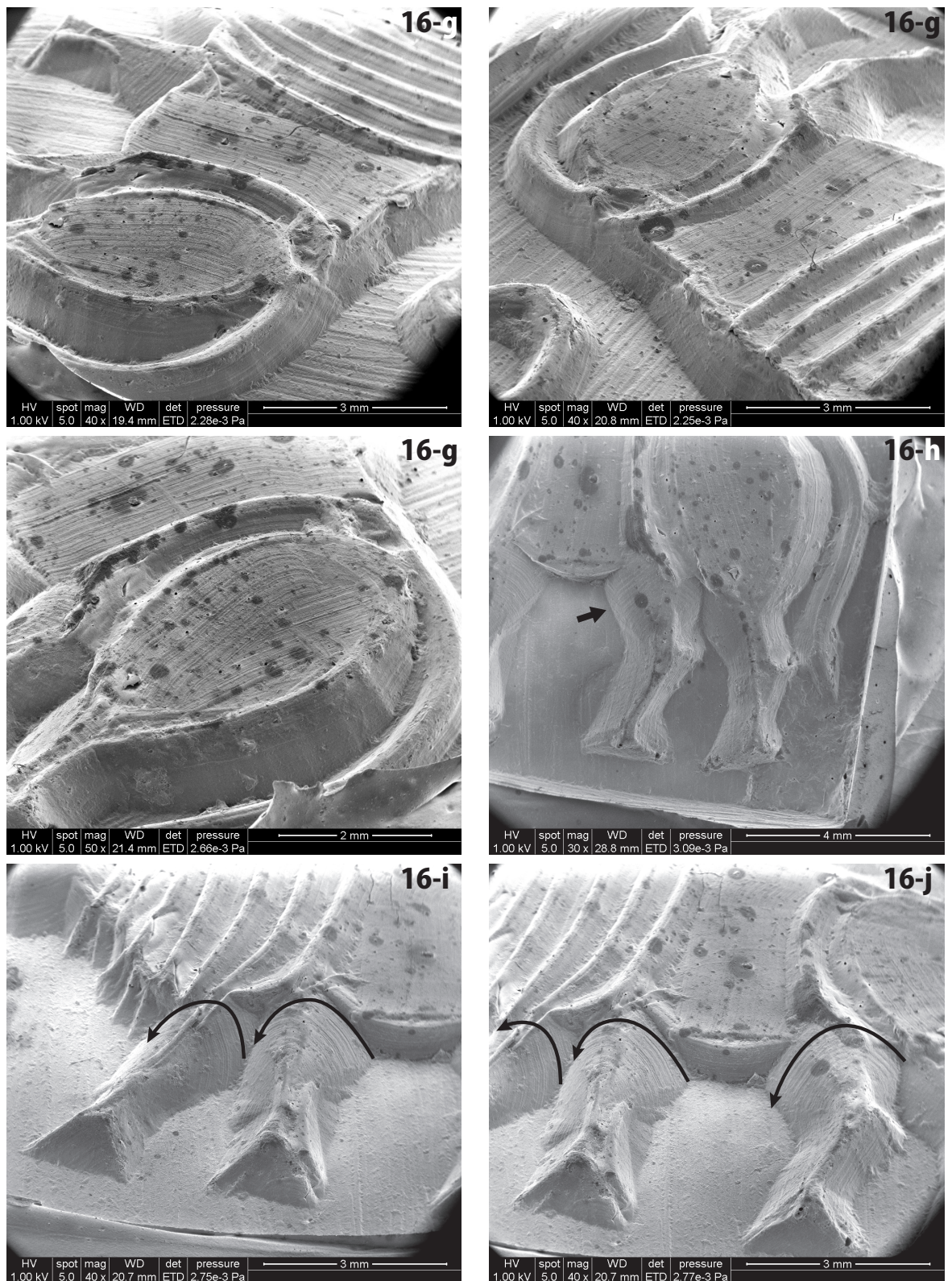
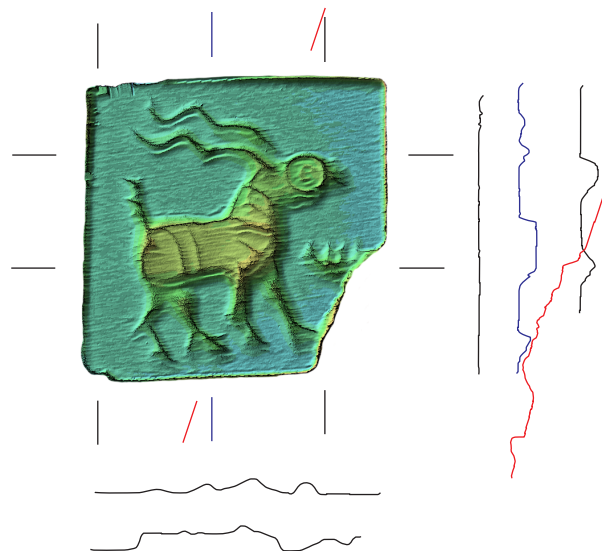


Figure 6.68: SEM images of Harappan seal discovered from the period II of Banawali



300%

Altitude [mm]



300%

Figure 6.69: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-6)

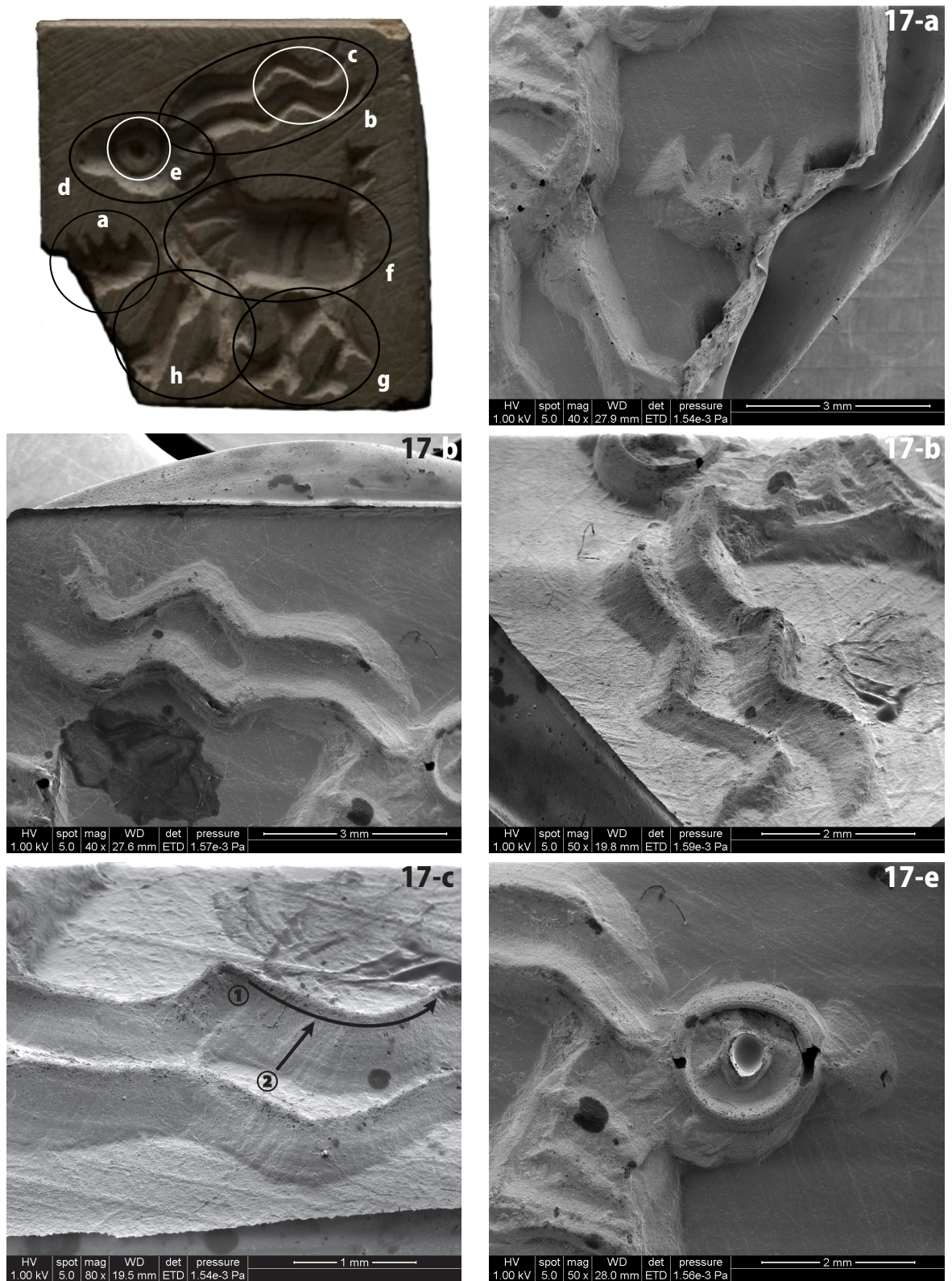


Figure 6.70: Photograph and SEM images of Harappan seal discovered from the period II of Banawali

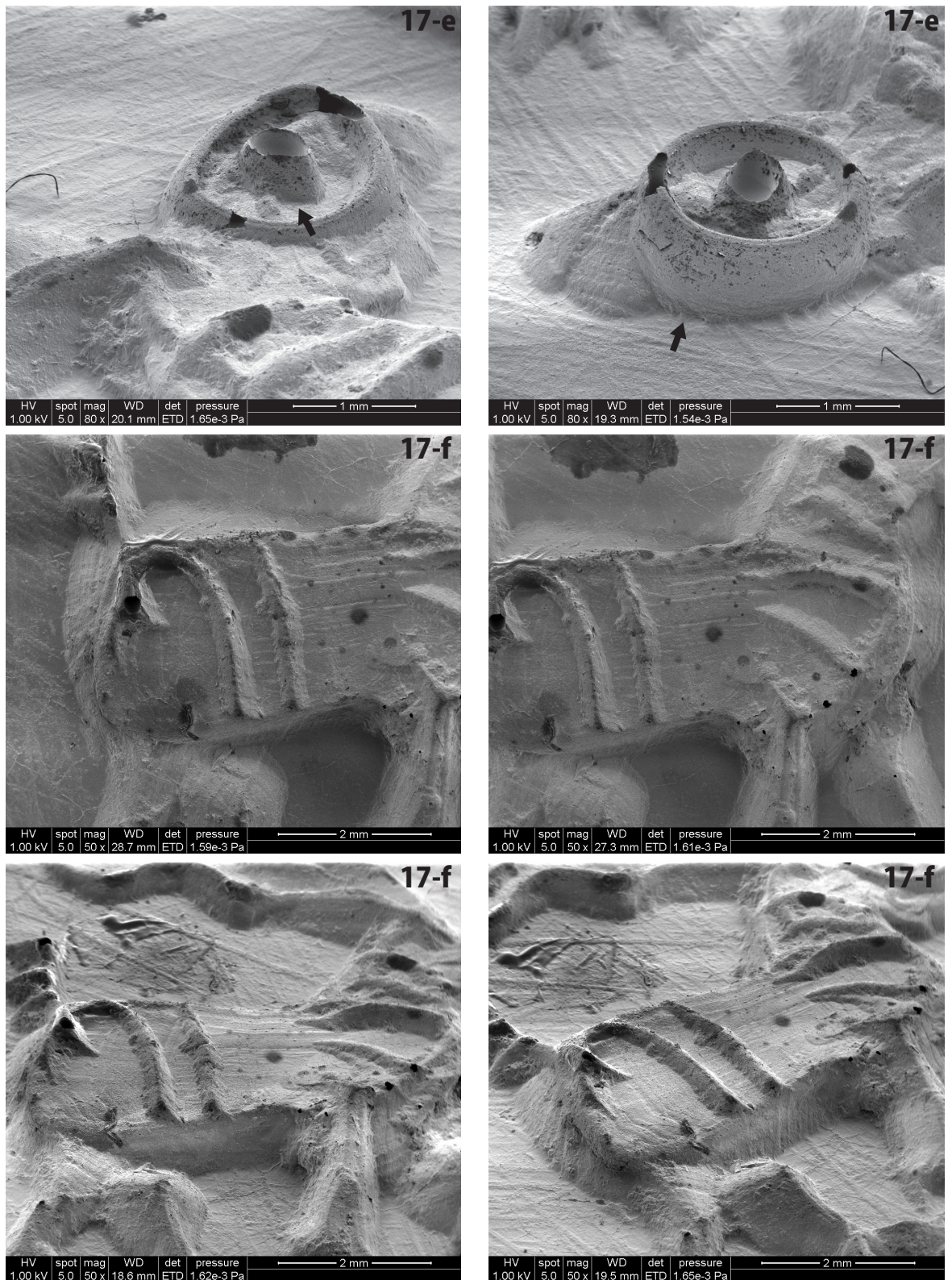


Figure 6.71: SEM images of Harappan seal discovered from the period II of Banawali

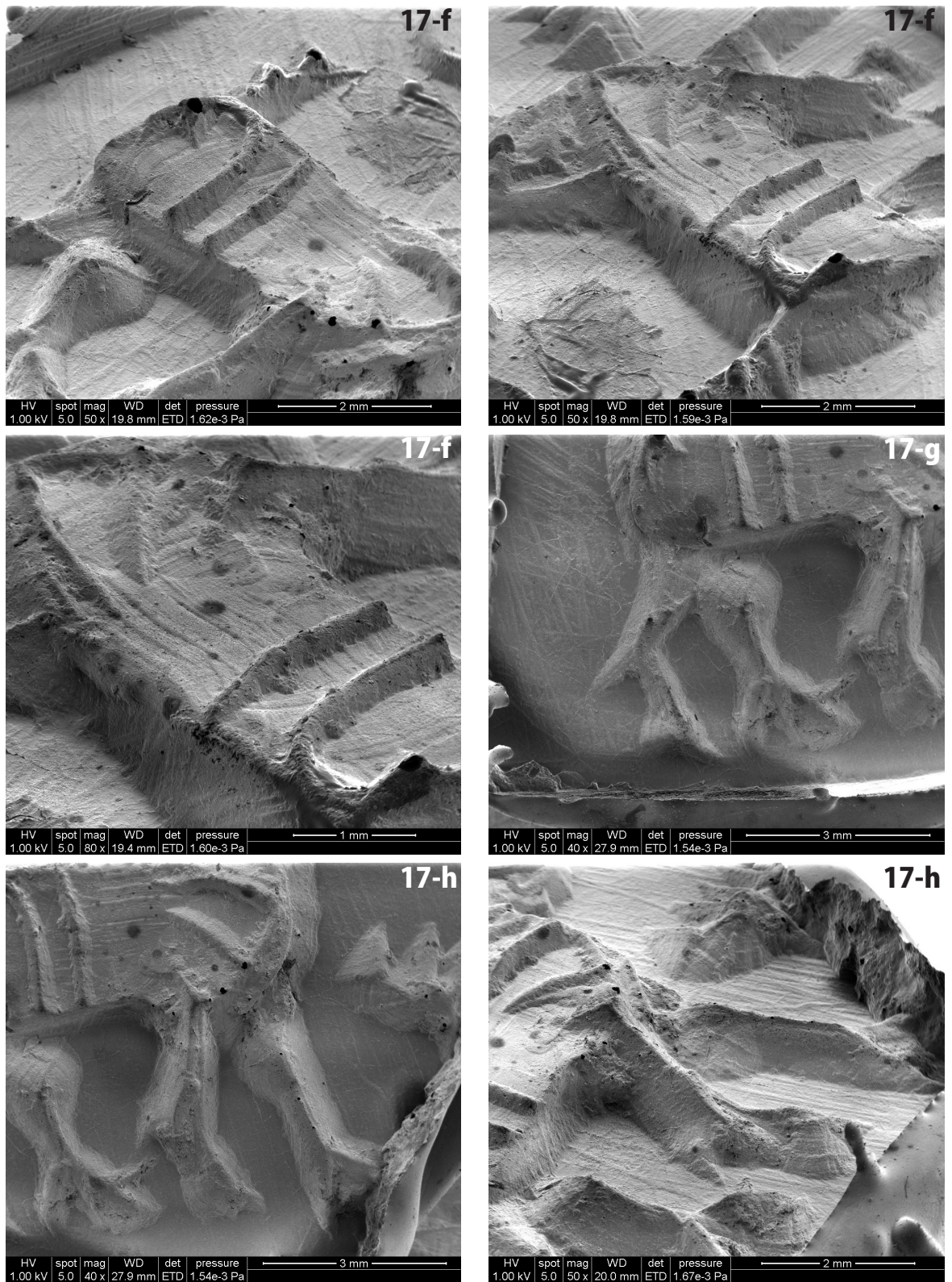
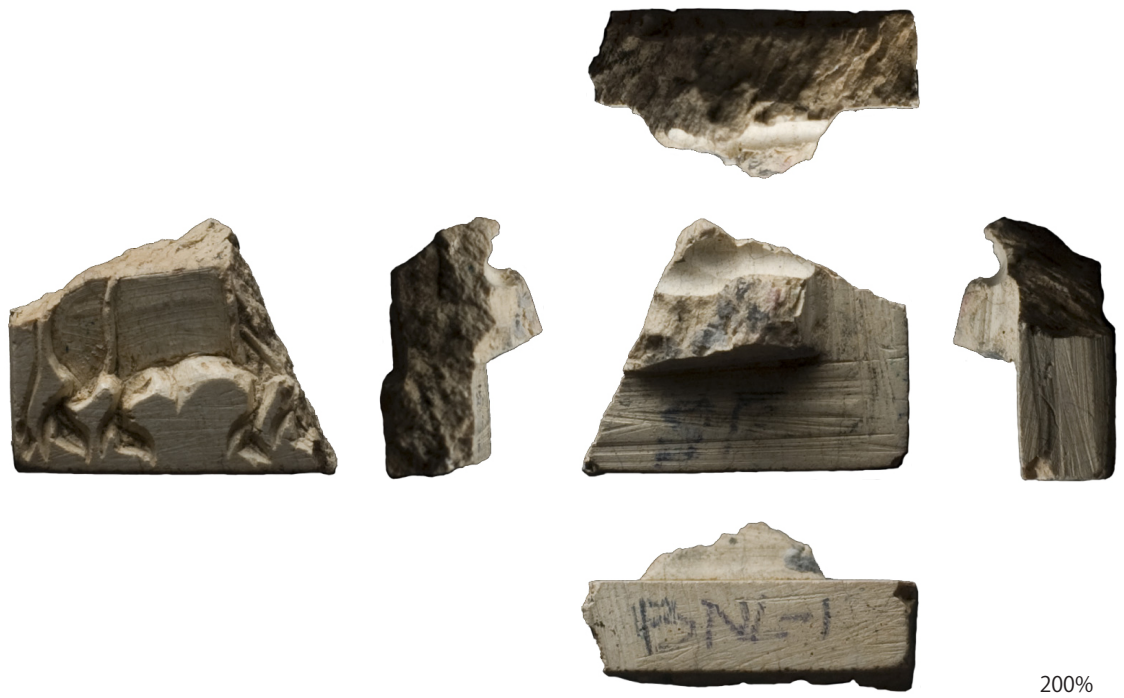
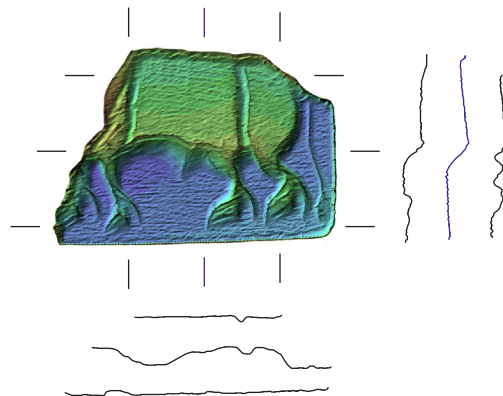
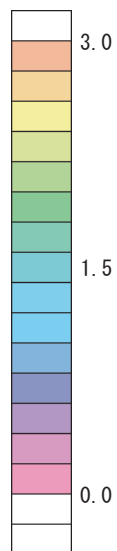


Figure 6.72: SEM images of Harappan seal discovered from the period II of Banawali



Altitude [mm]



200%

200%

Figure 6.73: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.4-1)



Altitude [mm]

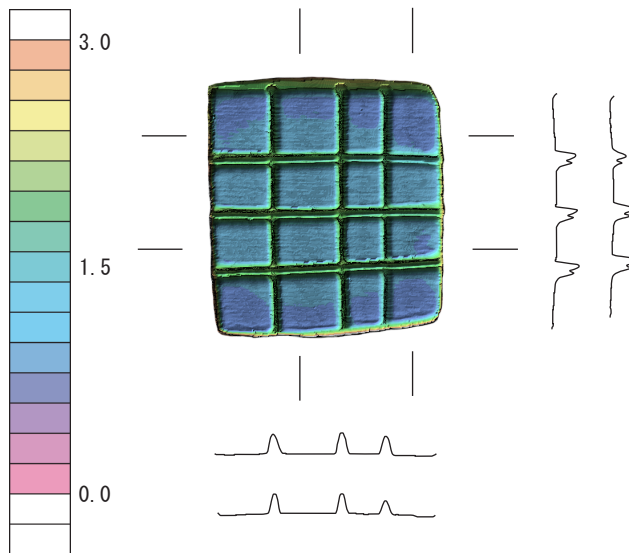


Figure 6.74: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 1.3-7)

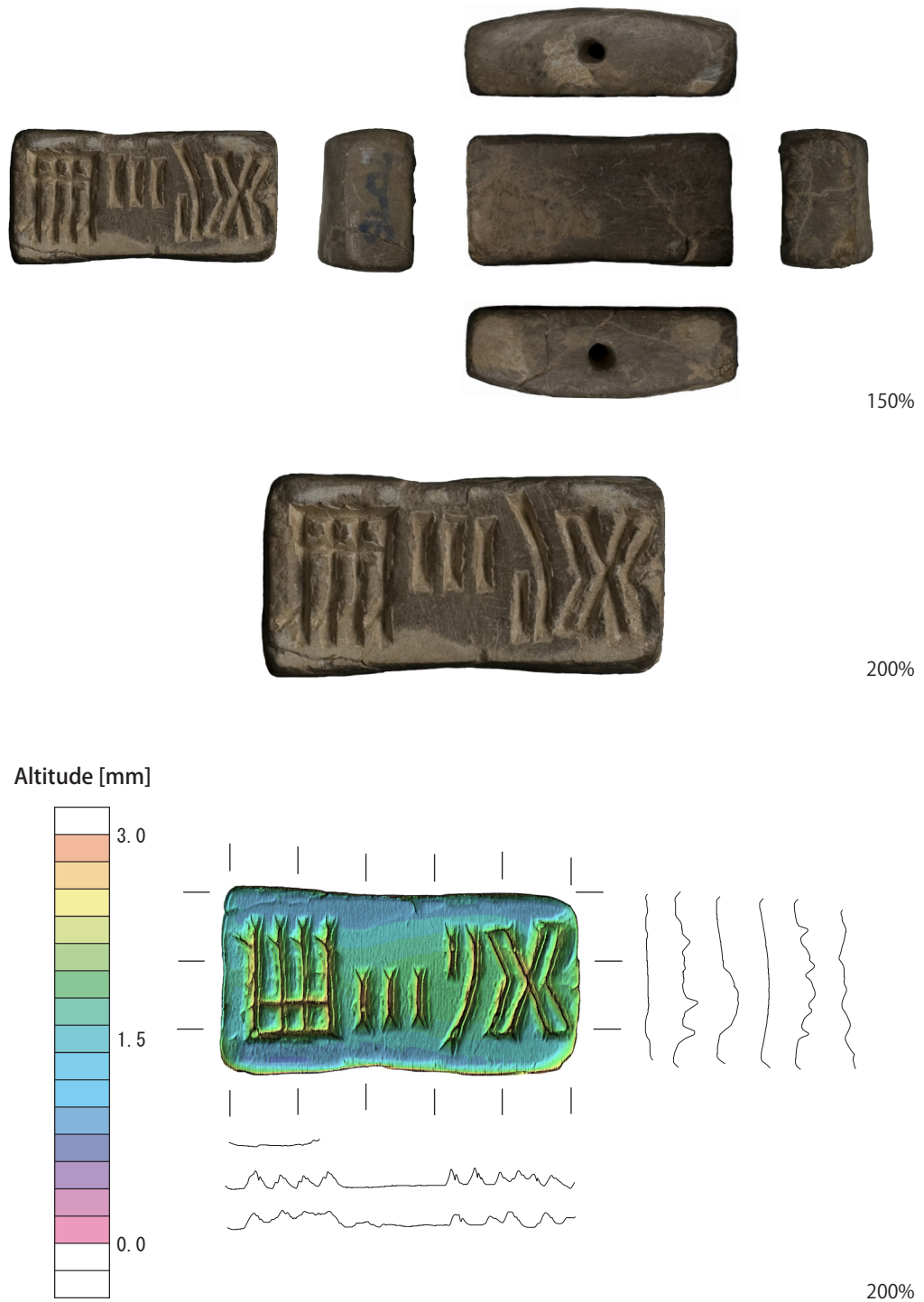


Figure 6.75: Photograph and PEAKIT image of Harappan seal discovered from the period II of Banawali (see also Figure 4.3-1)

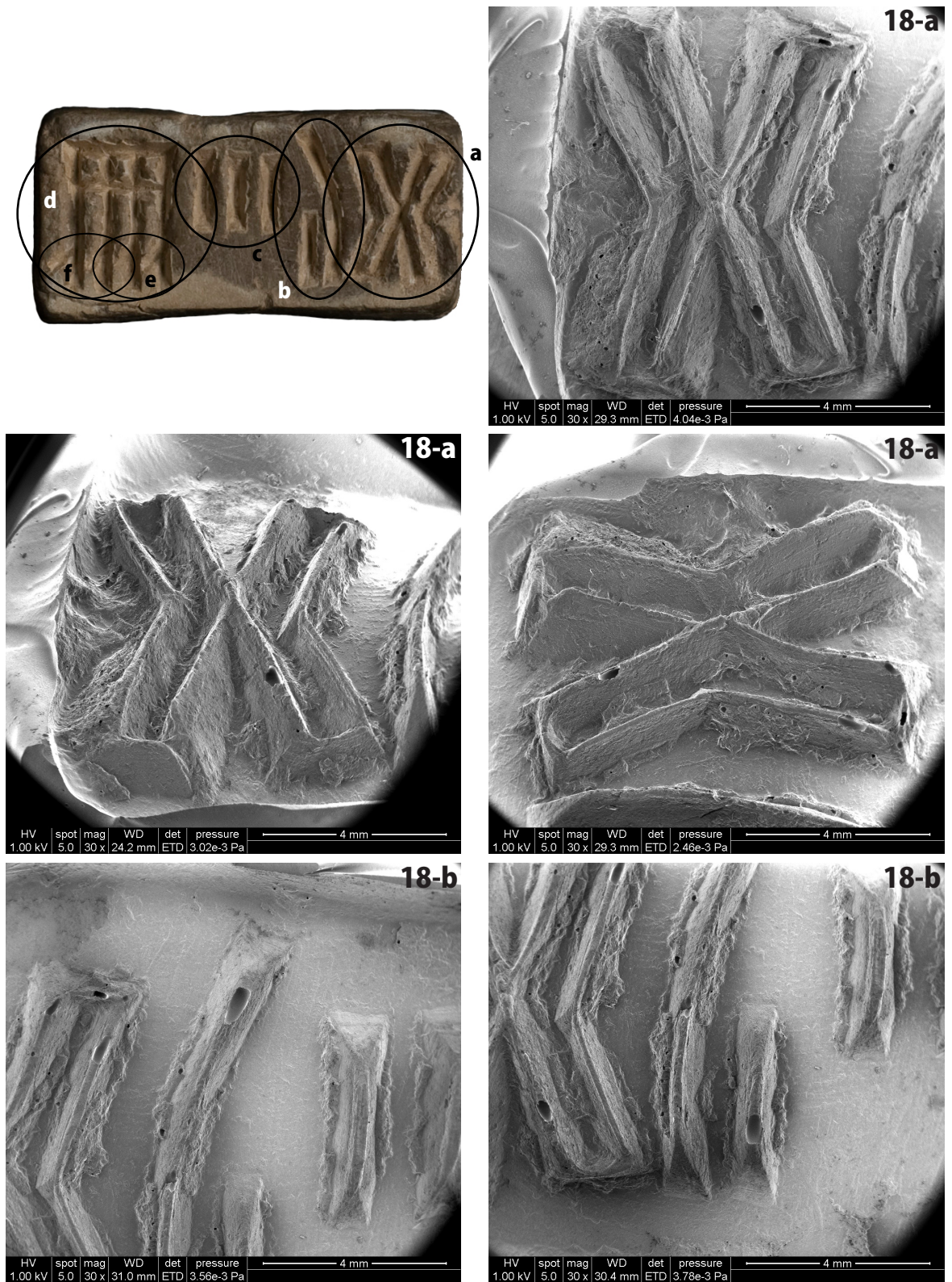


Figure 6.76: Photograph and SEM images of Harappan convex type seal discovered from the period II of Banawali

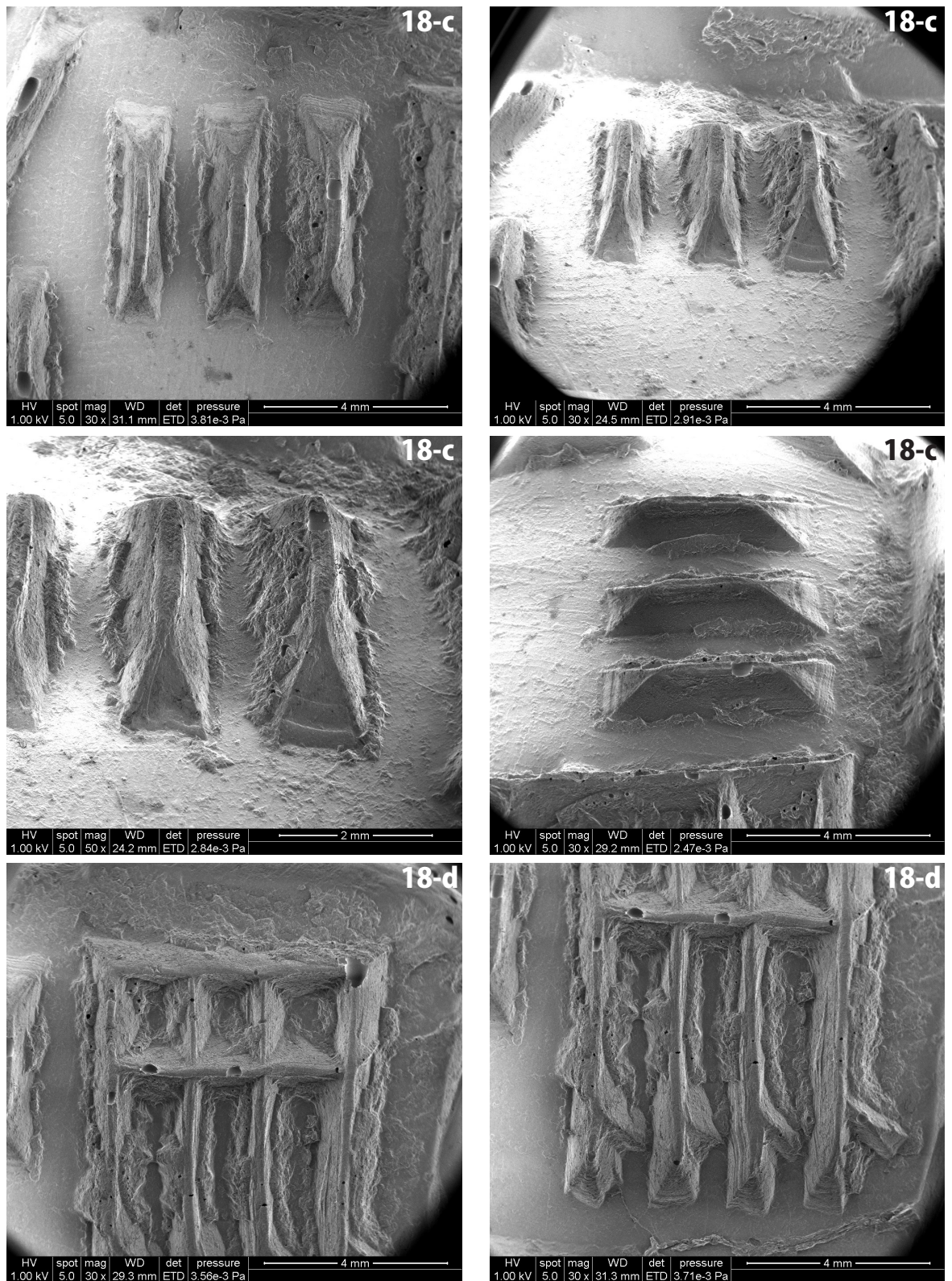


Figure 6.77: SEM images of Harappan convex type seal discovered from the period II of Banawali

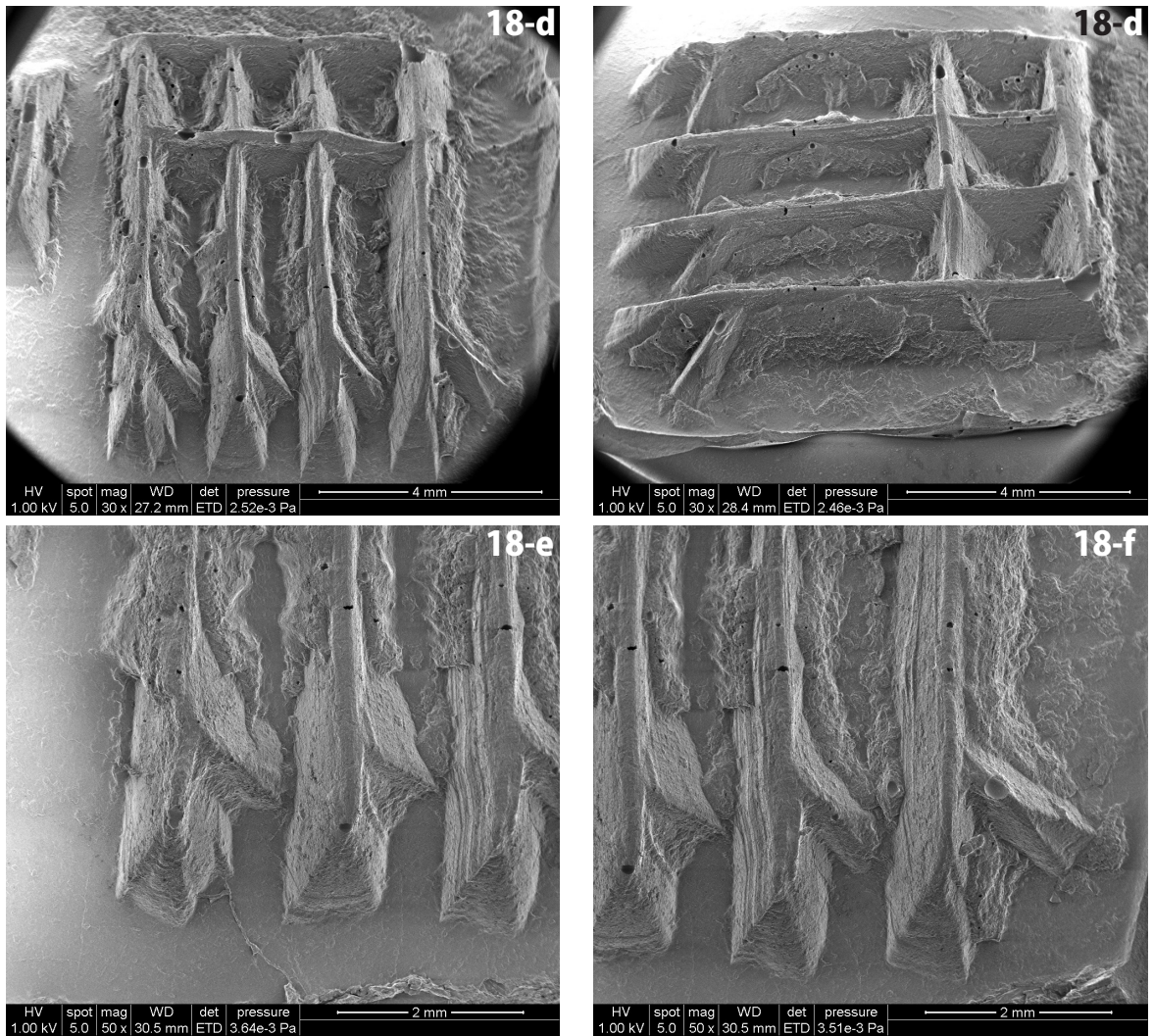


Figure 6.78: SEM images of Harappan convex type seal discovered from the period II of Banawali

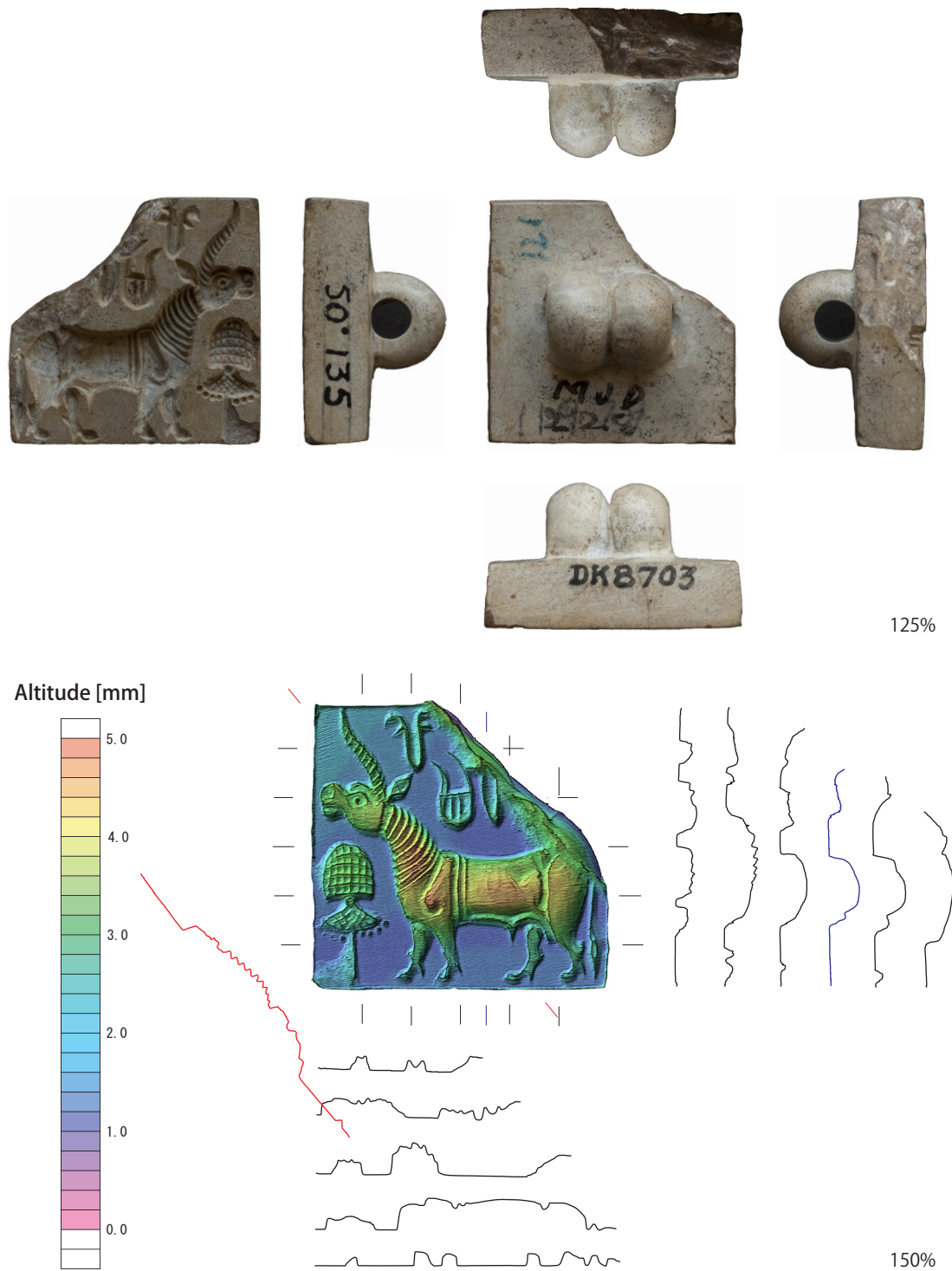


Figure 6.79: Photograph and PEAKIT image of Harappan seal discovered from Mohenjodaro

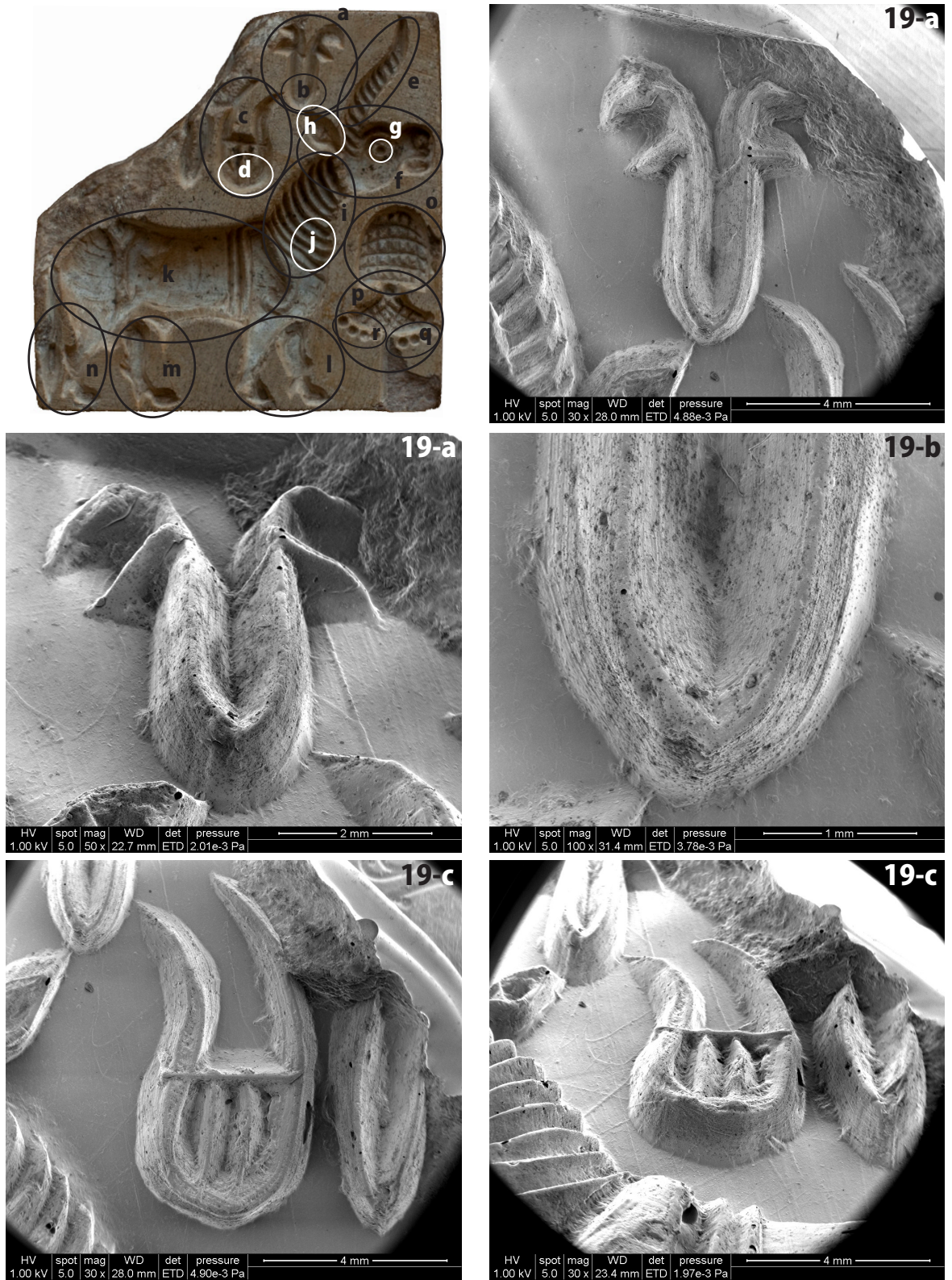


Figure 6.80: Photograph and SEM images of Harappan seal discovered from Mohenjodaro

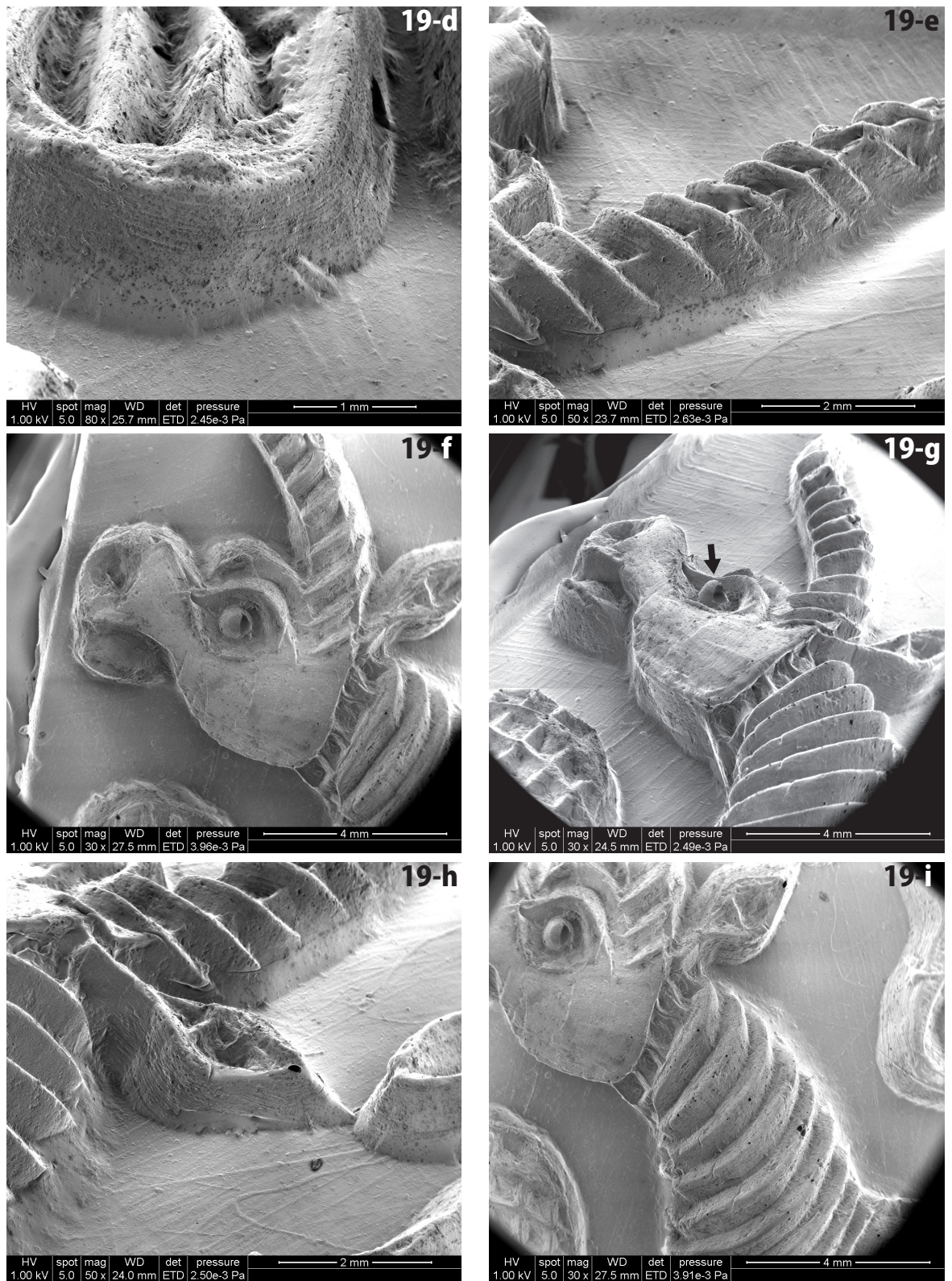


Figure 6.81: SEM images of Harappan seal discovered from Mohenjodaro

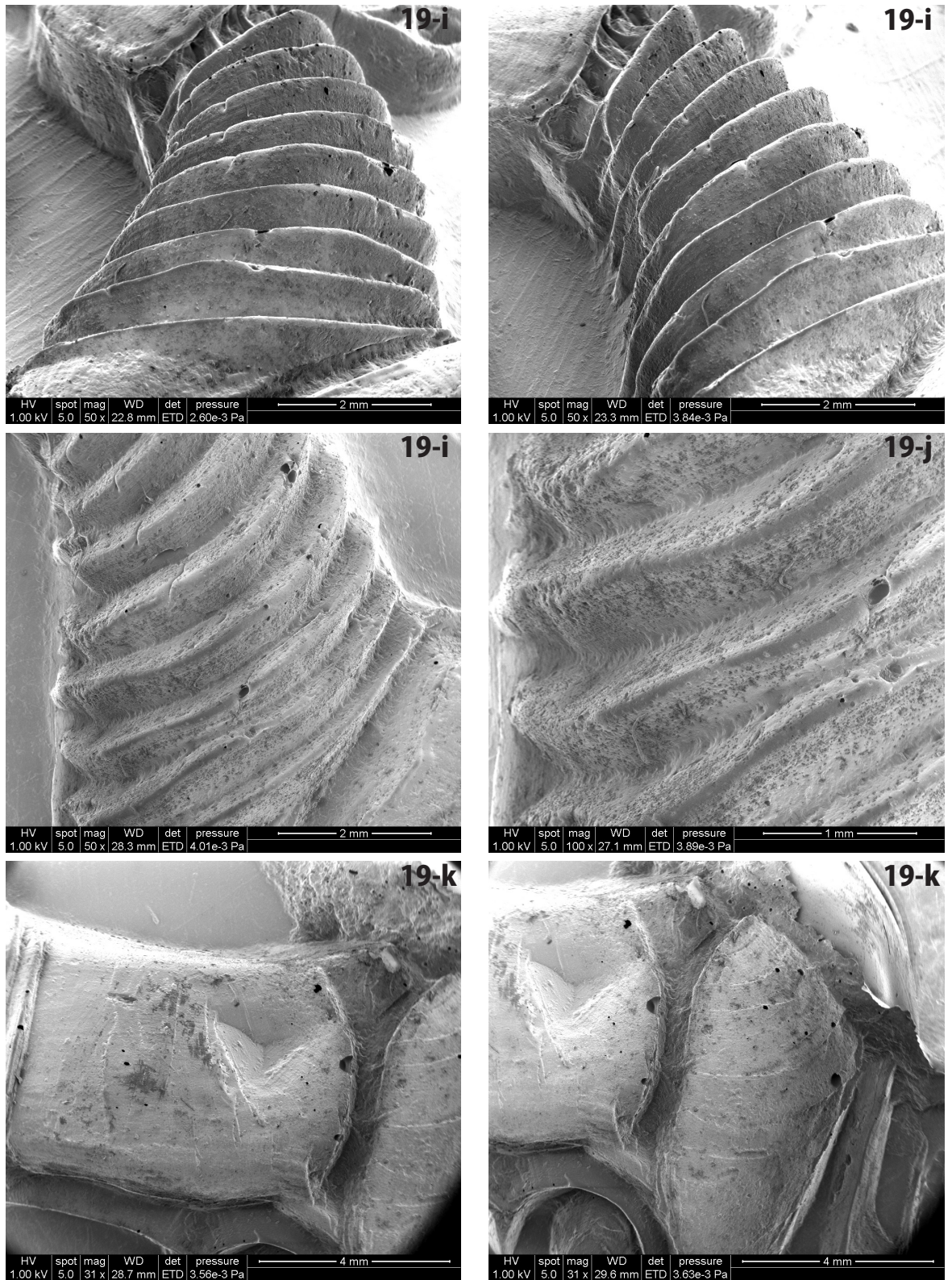


Figure 6.82: SEM images of Harappan seal discovered from Mohenjodaro

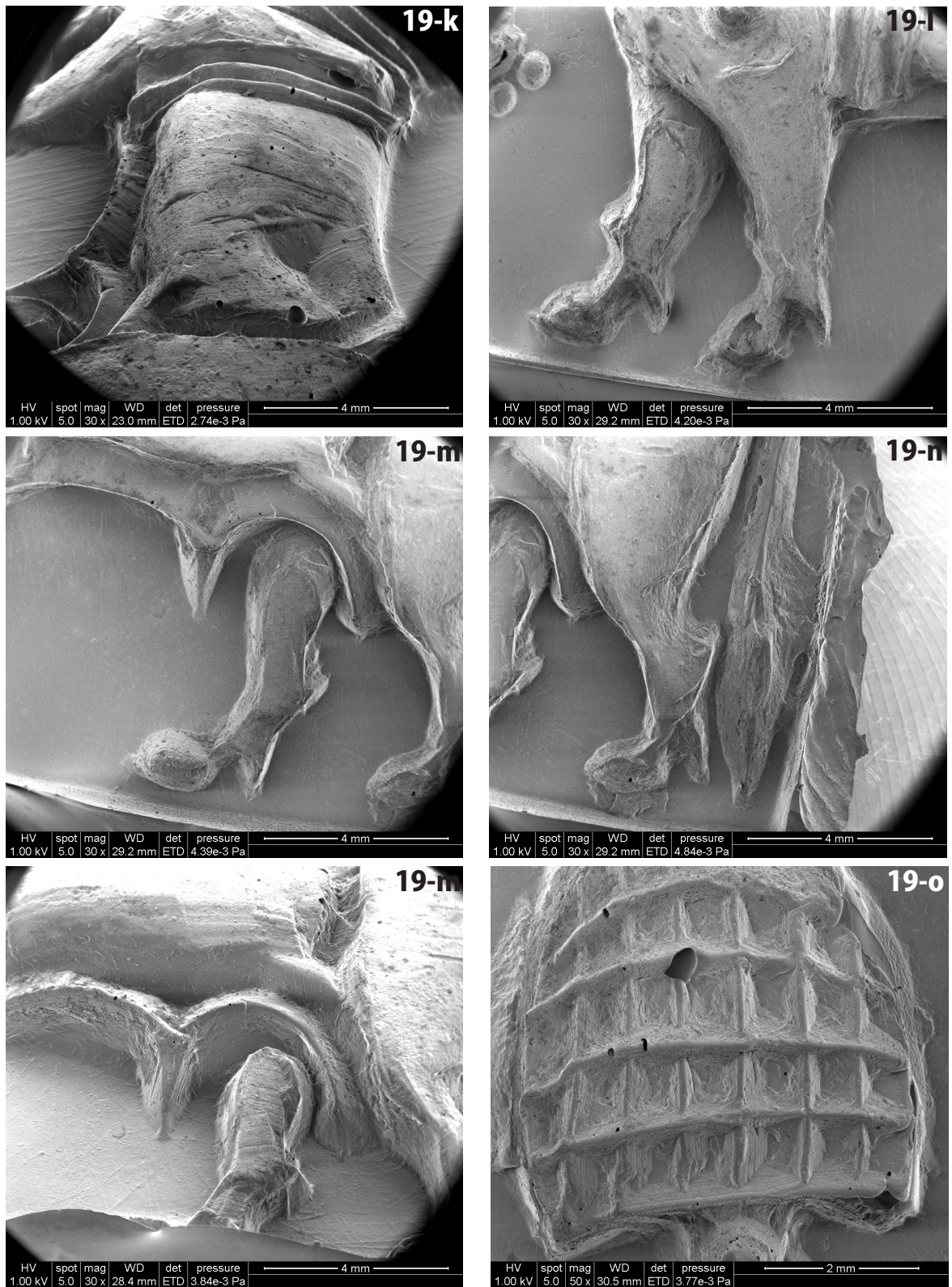


Figure 6.83: SEM images of Harappan seal discovered from Mohenjodaro

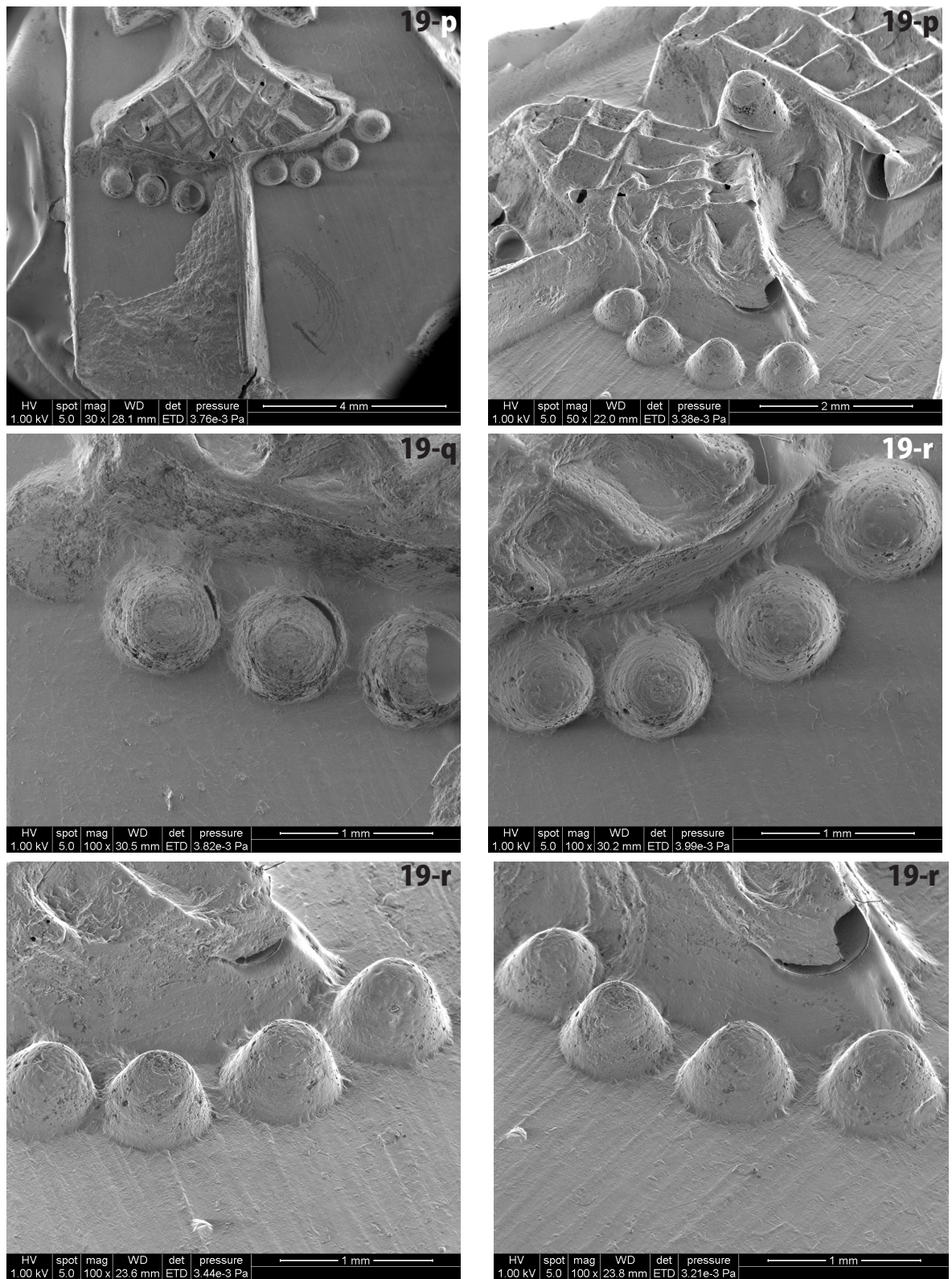


Figure 6.84: SEM images of Harappan seal discovered from Mohenjodaro

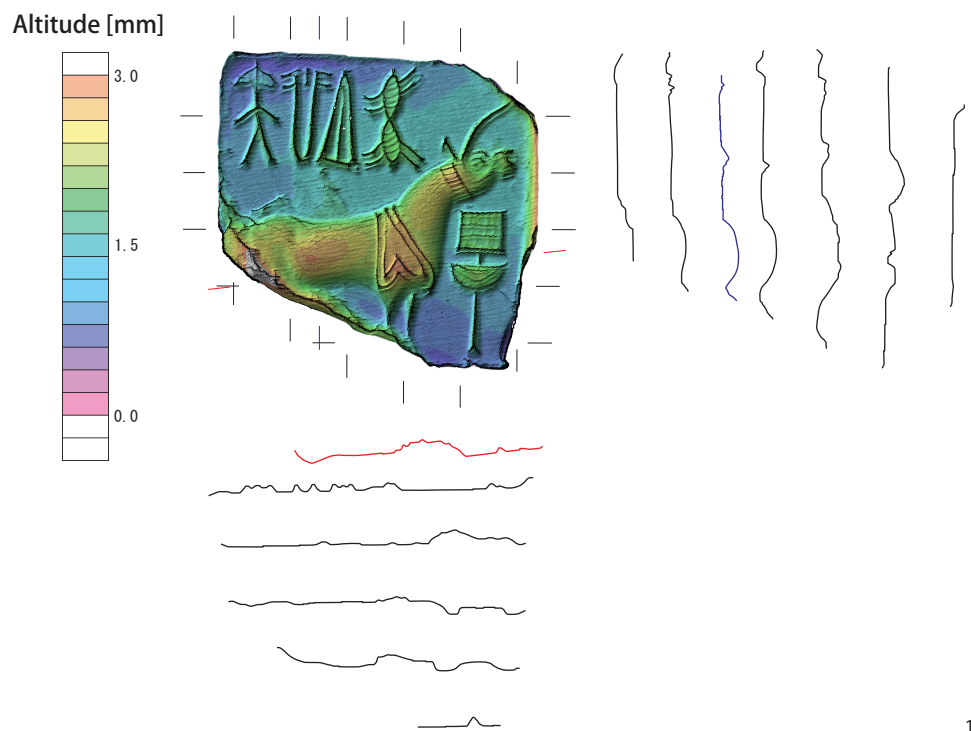


Figure 6.85: Photograph and PEAKIT image of Harappan seal discovered from Mohenjodaro

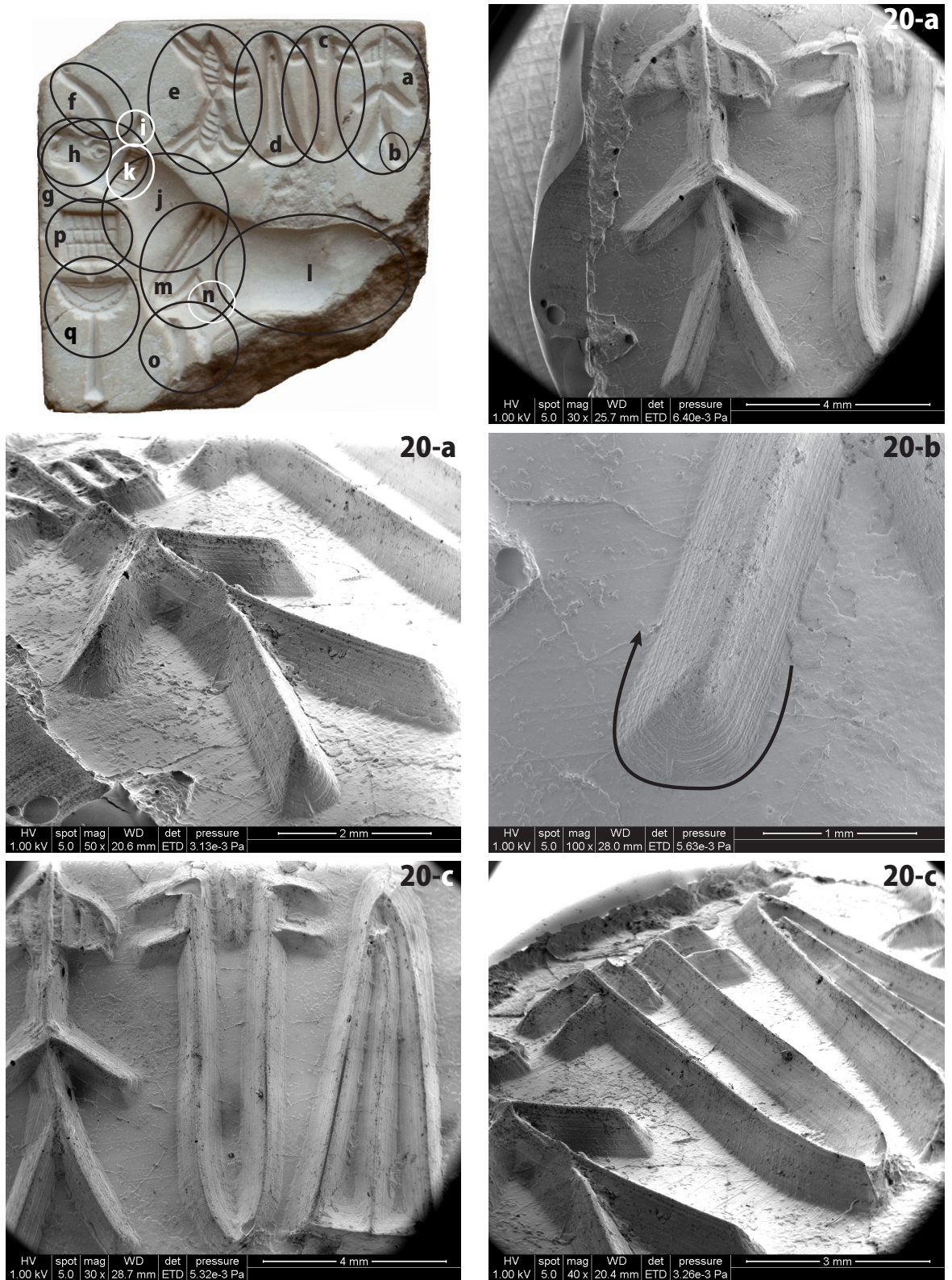


Figure 6.86: Photograph and SEM images of Harappan seal discovered from Mohenjodaro

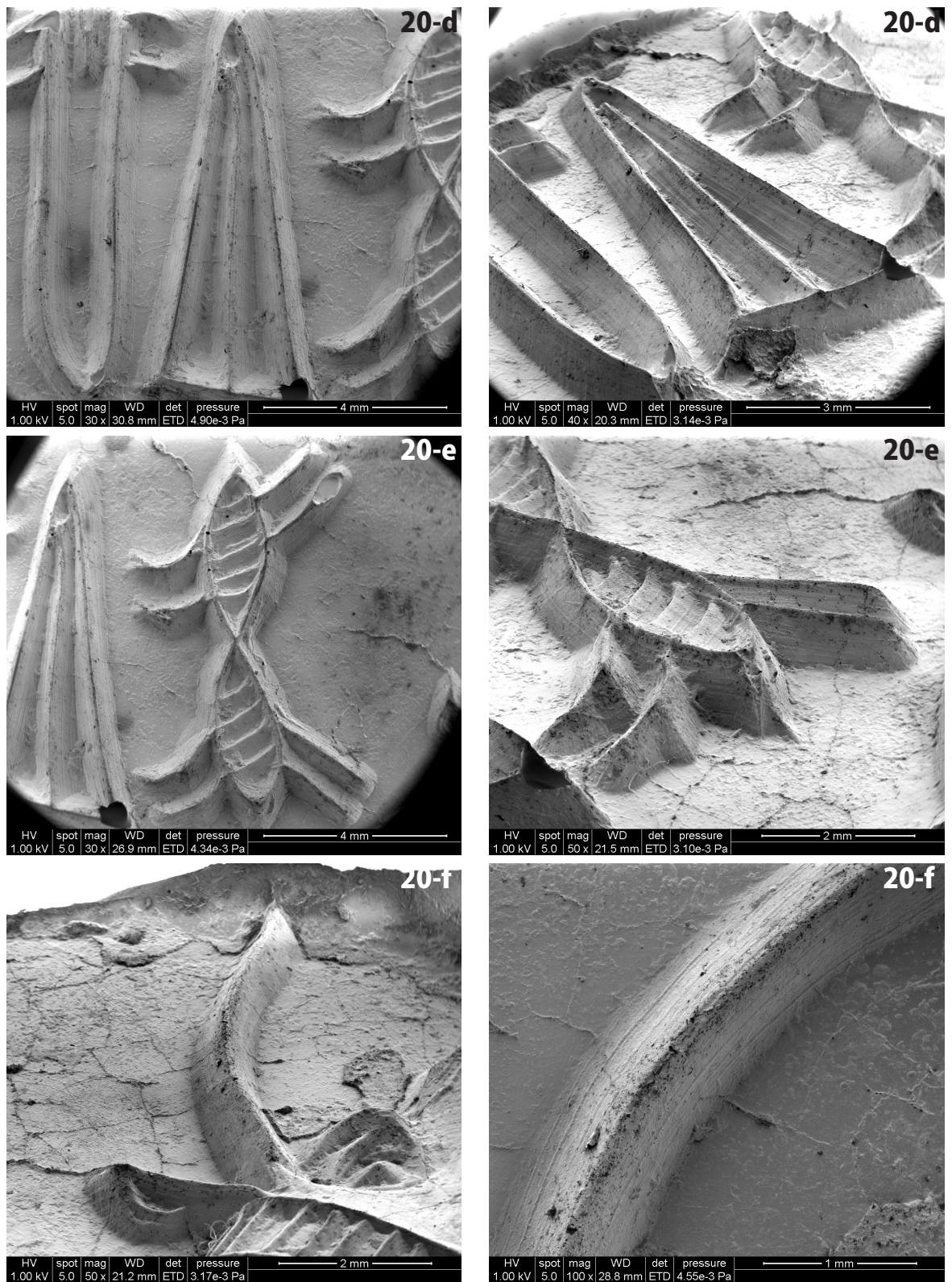


Figure 6.87: SEM images of Harappan seal discovered from Mohenjodaro

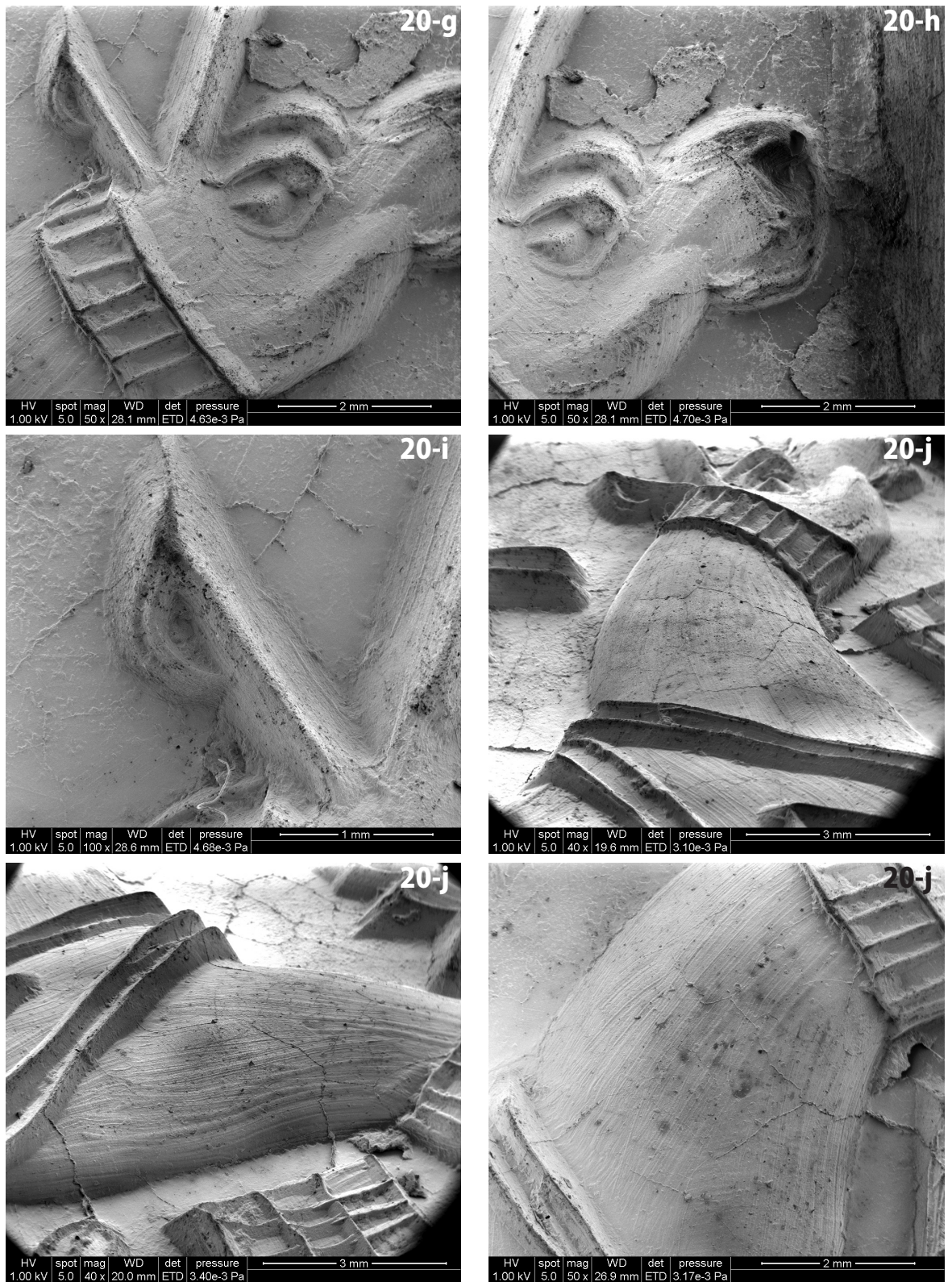


Figure 6.88: SEM images of Harappan seal discovered from Mohenjodaro

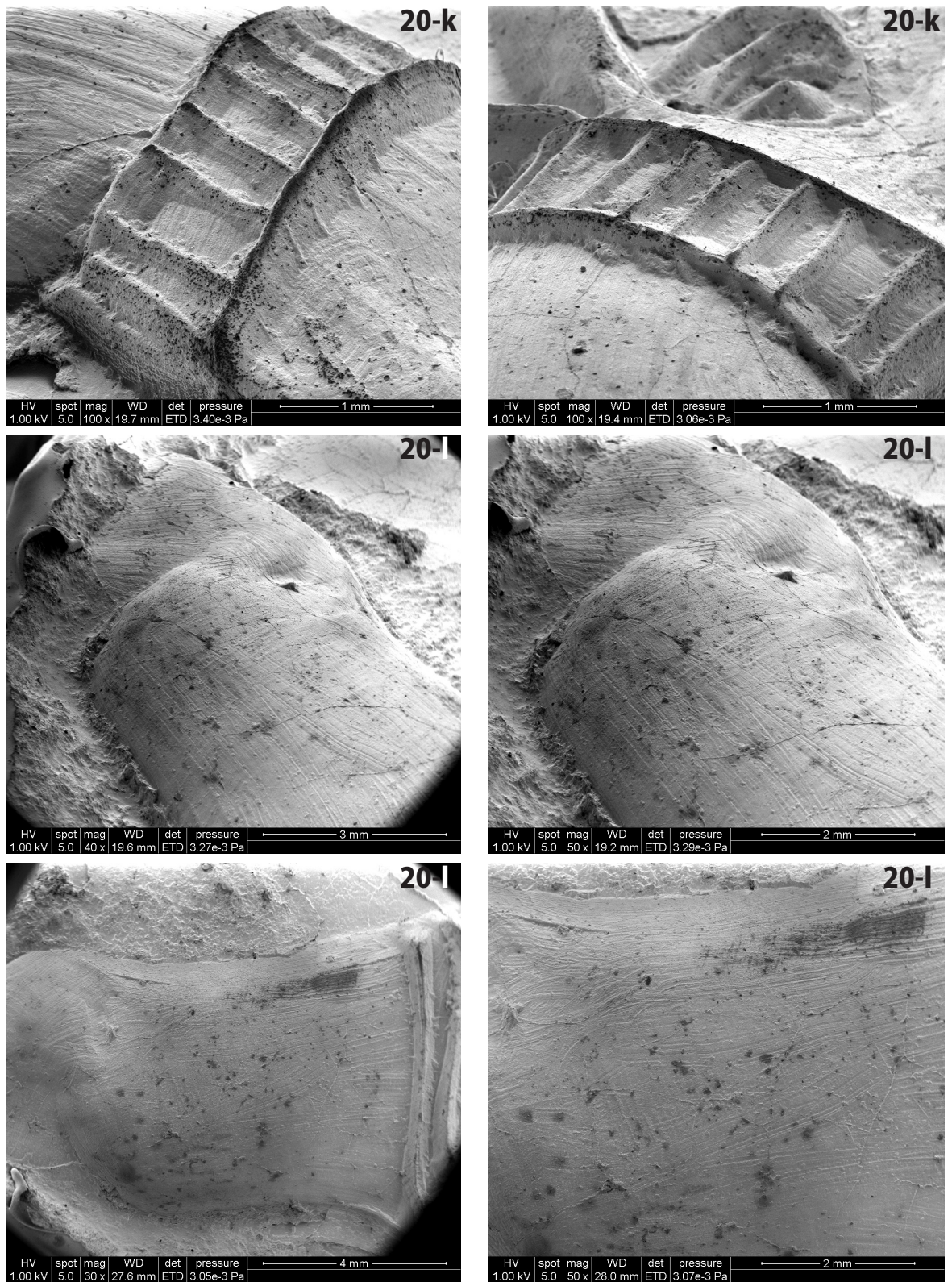


Figure 6.89: SEM images of Harappan seal discovered from Mohenjodaro

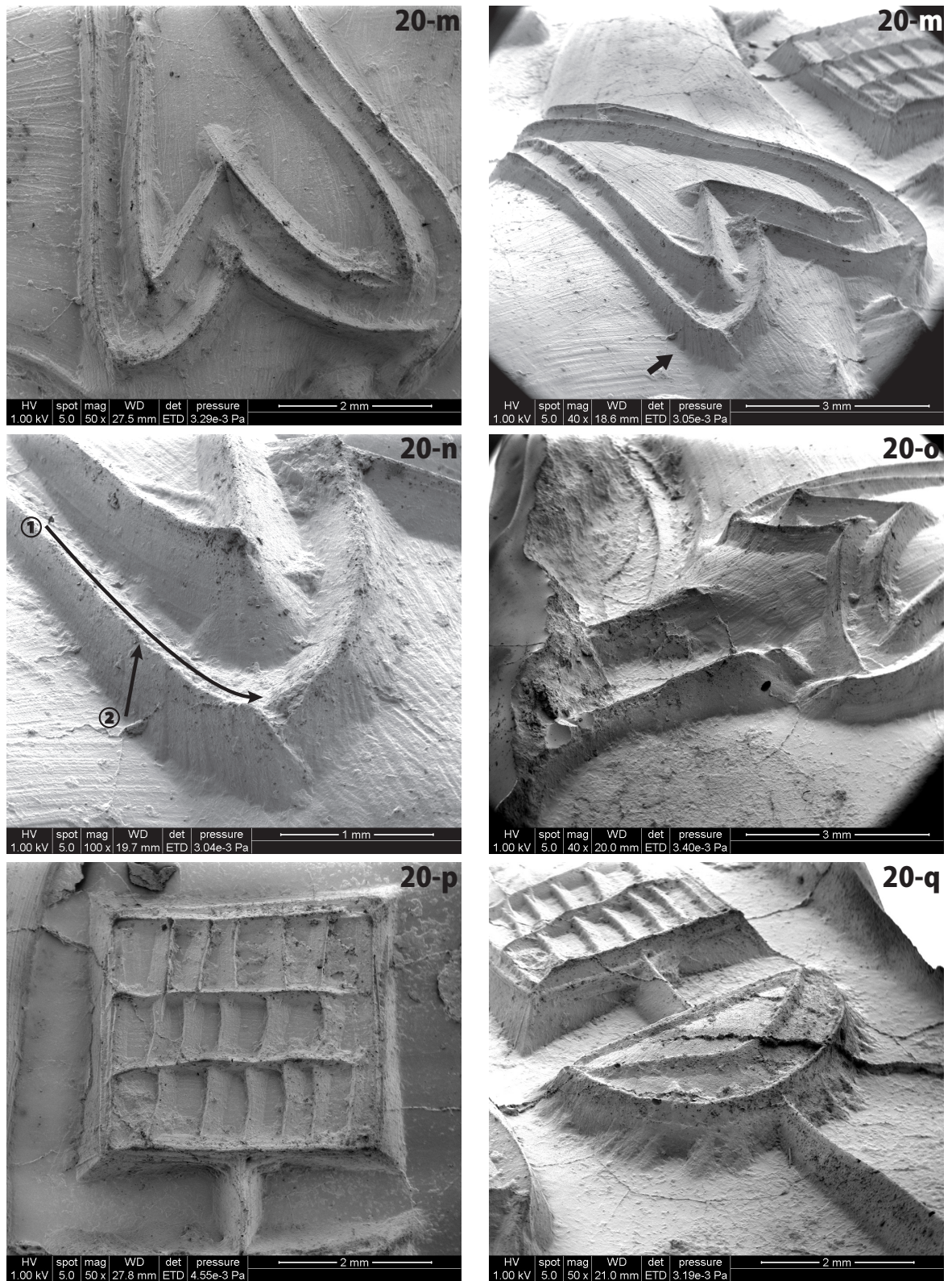


Figure 6.90: SEM images of Harappan seal discovered from Mohenjodaro

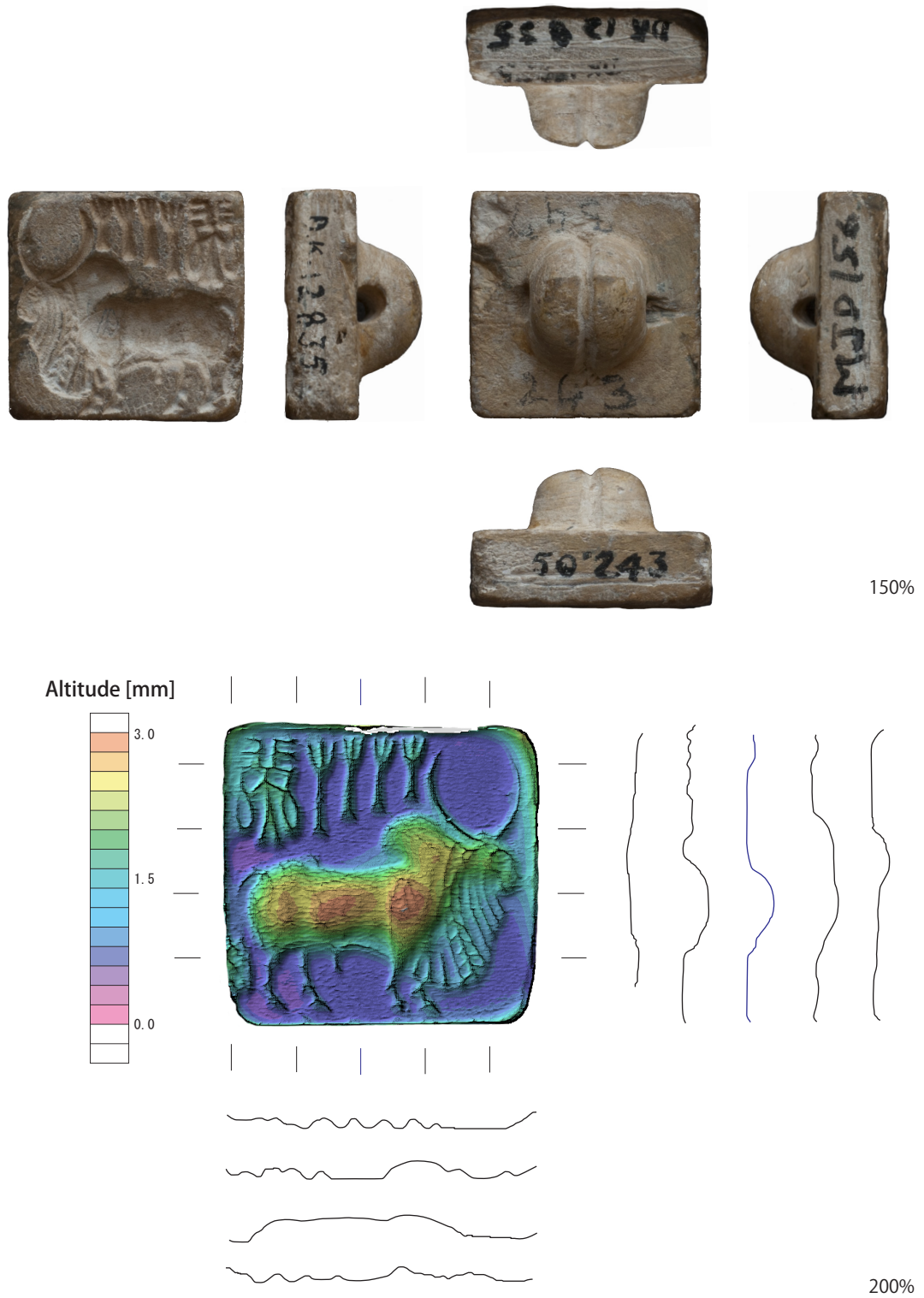


Figure 6.91: Photograph and PEAKIT image of Harappan seal discovered from Mohenjodaro

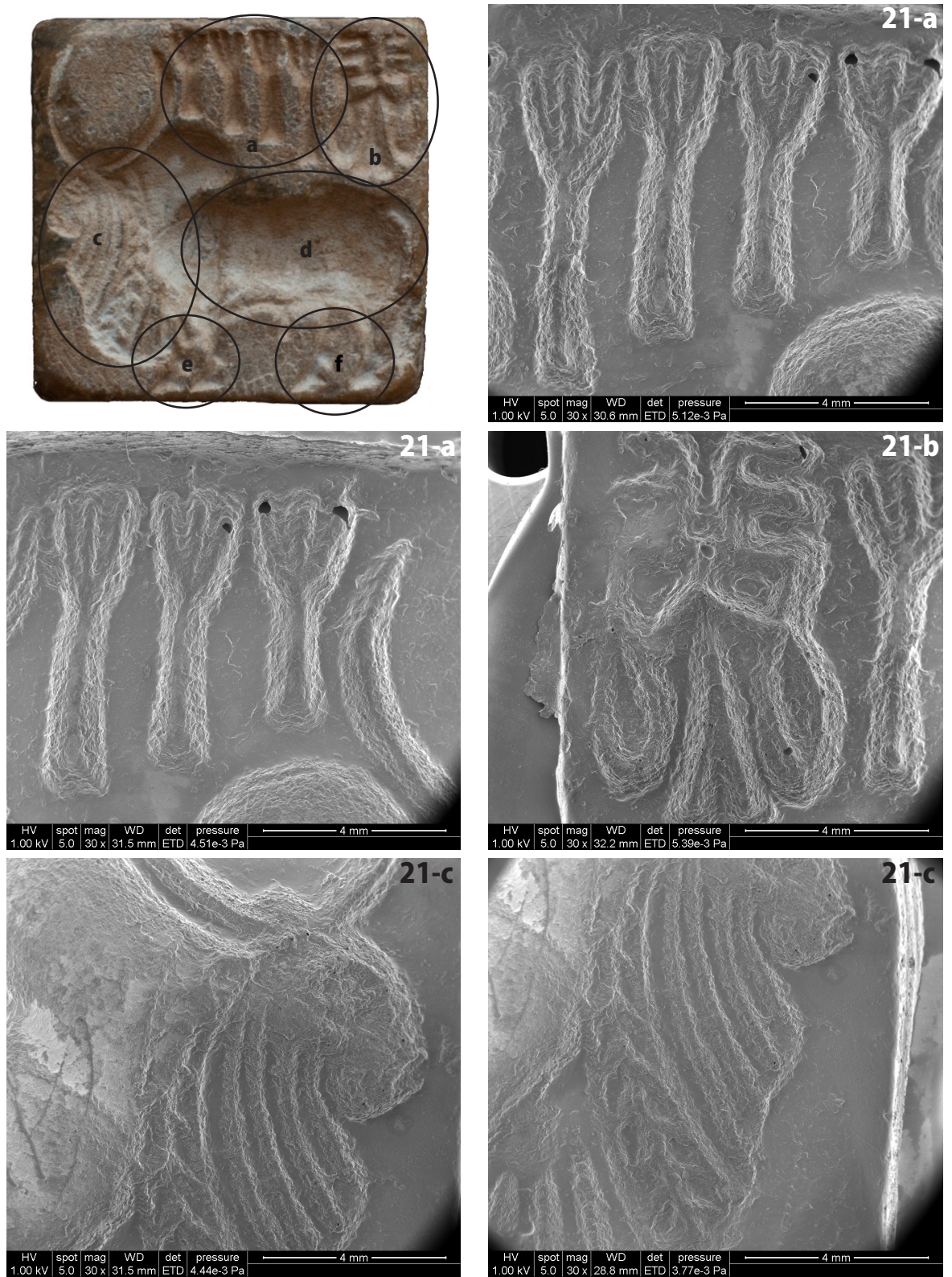


Figure 6.92: Photograph and SEM images of Harappan seal discovered from Mohenjodaro

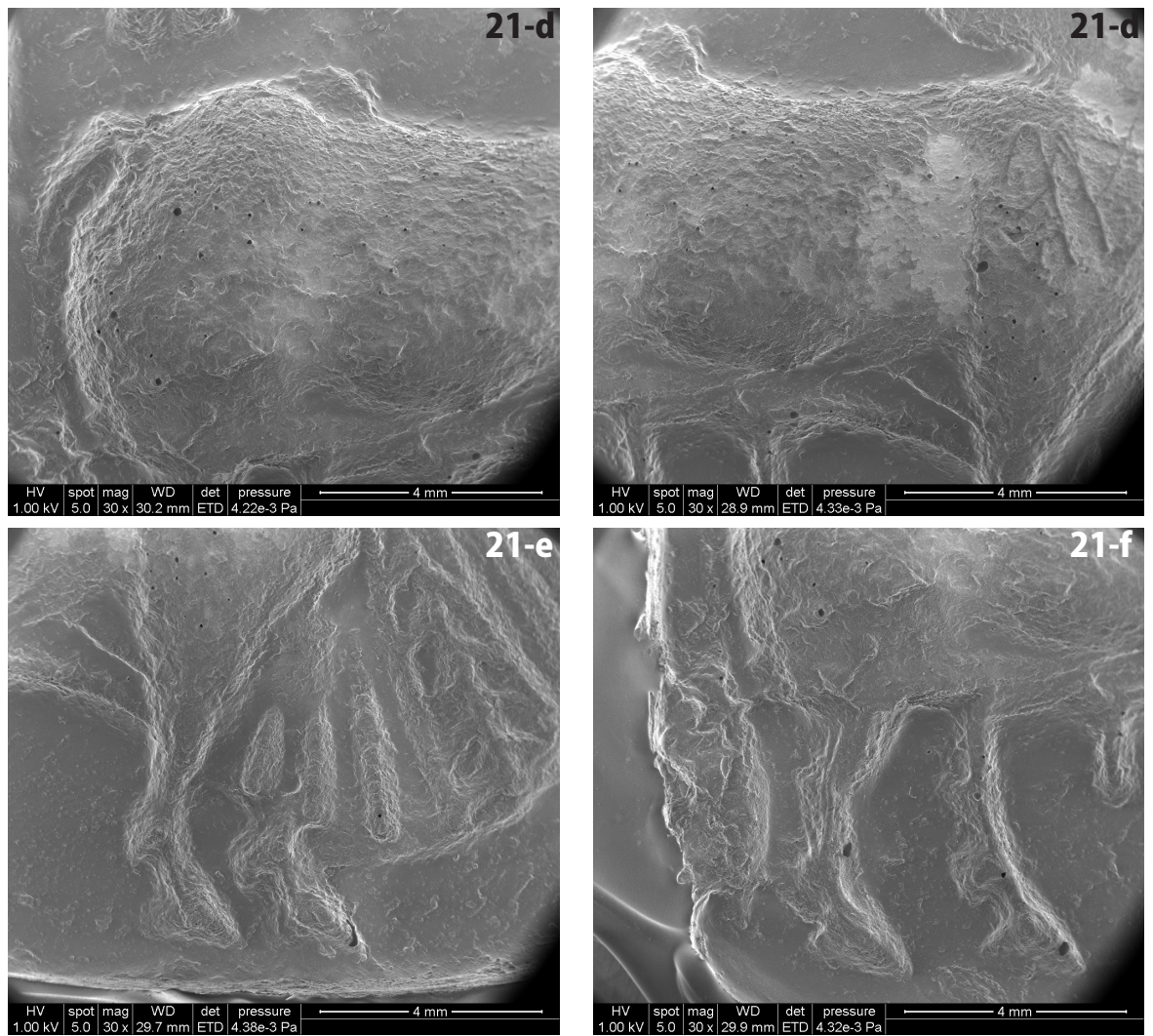


Figure 6.93: SEM images of Harappan seal discovered from Mohenjodaro

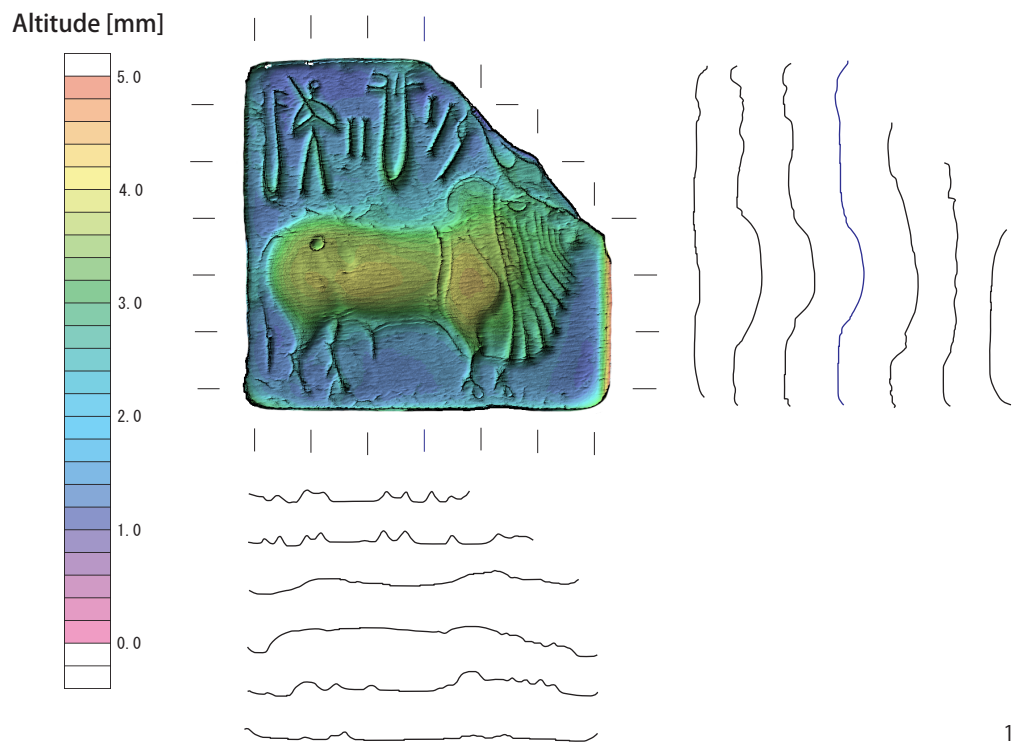


Figure 6.94: Photograph and PEAKIT image of Harappan seal discovered from Mohenjodaro

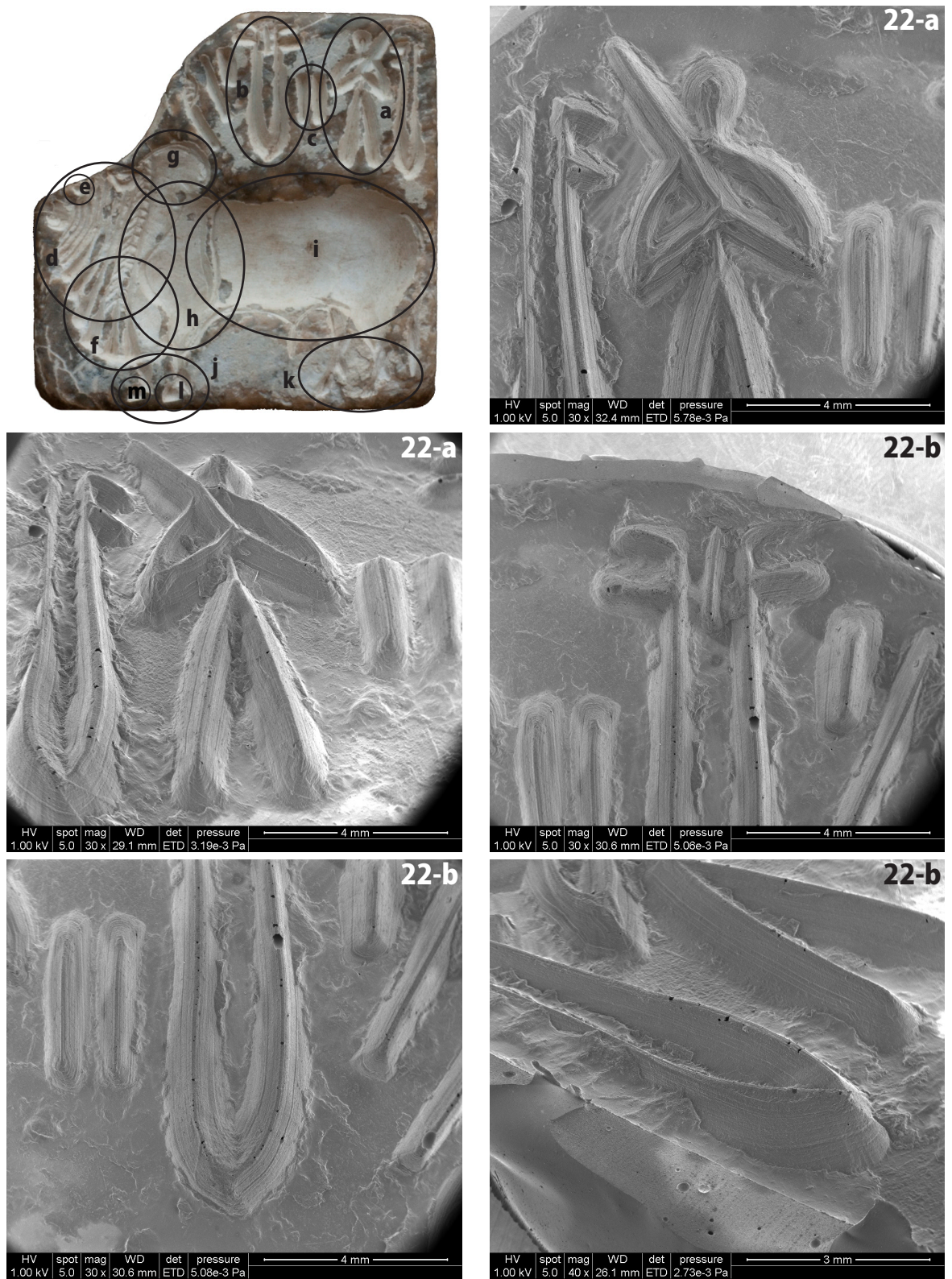


Figure 6.95: Photograph and SEM images of Harappan seal discovered from Mohenjodaro

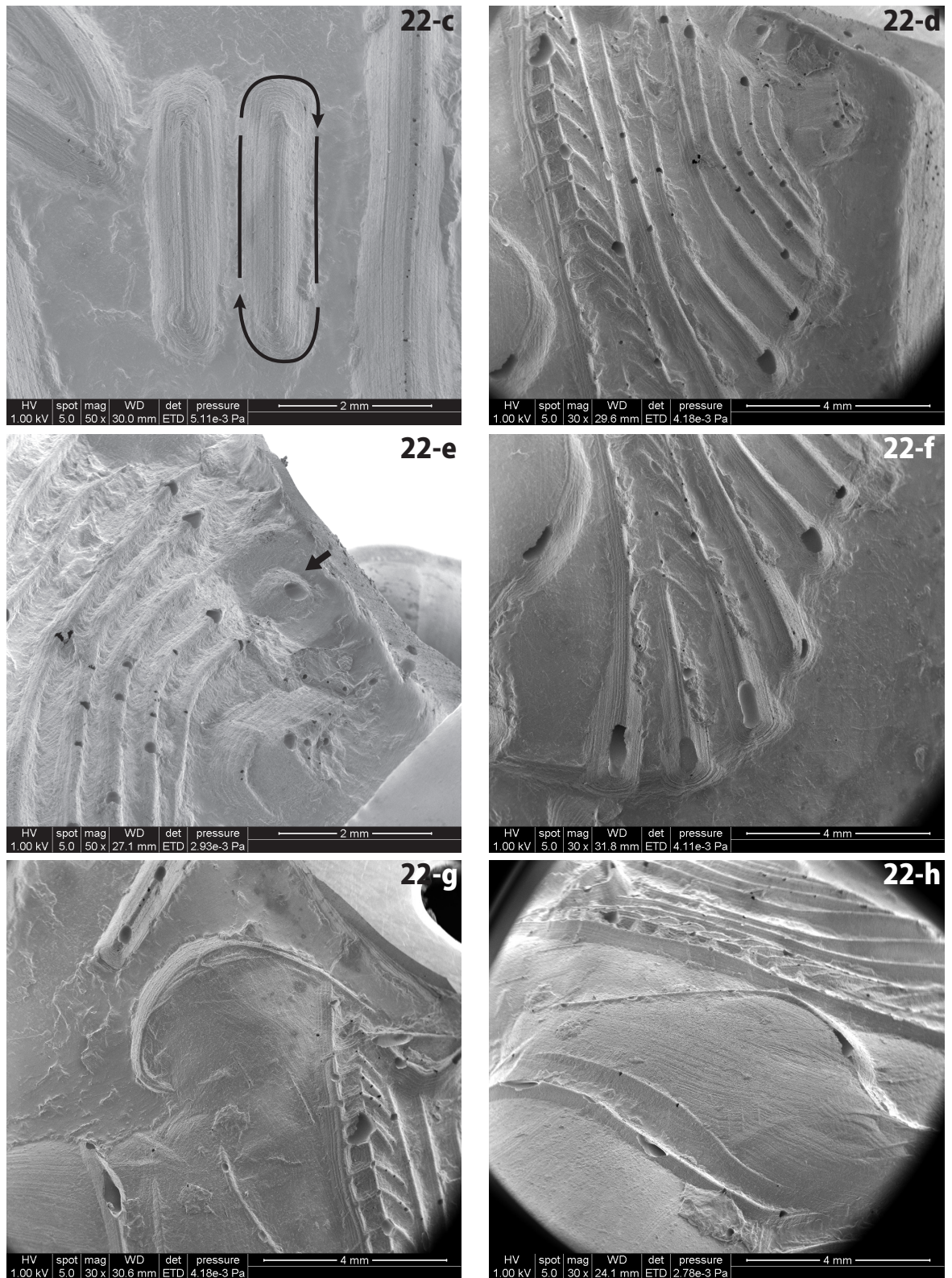


Figure 6.96: SEM images of Harappan seal discovered from Mohenjodaro

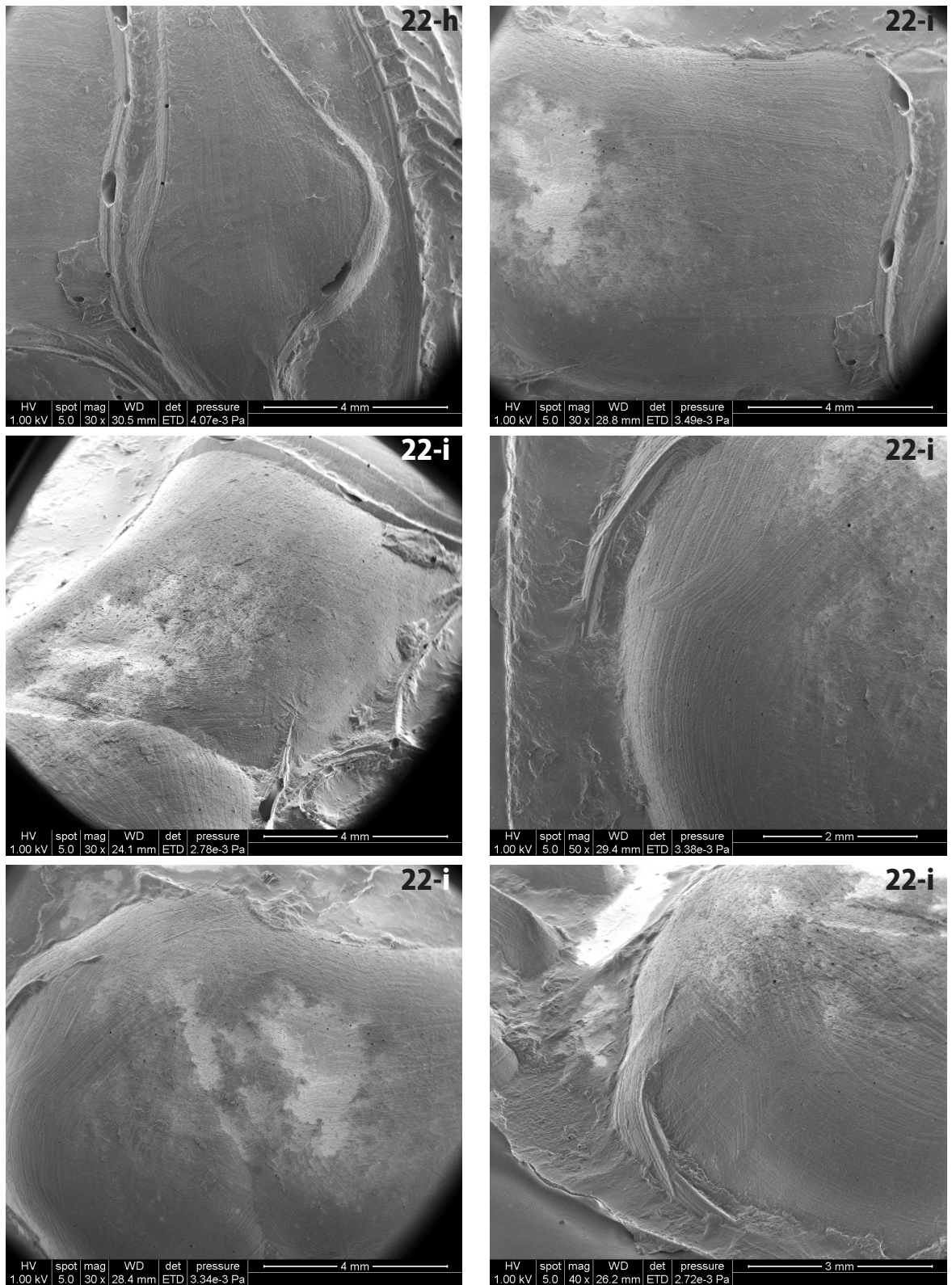


Figure 6.97: SEM images of Harappan seal discovered from Mohenjodaro

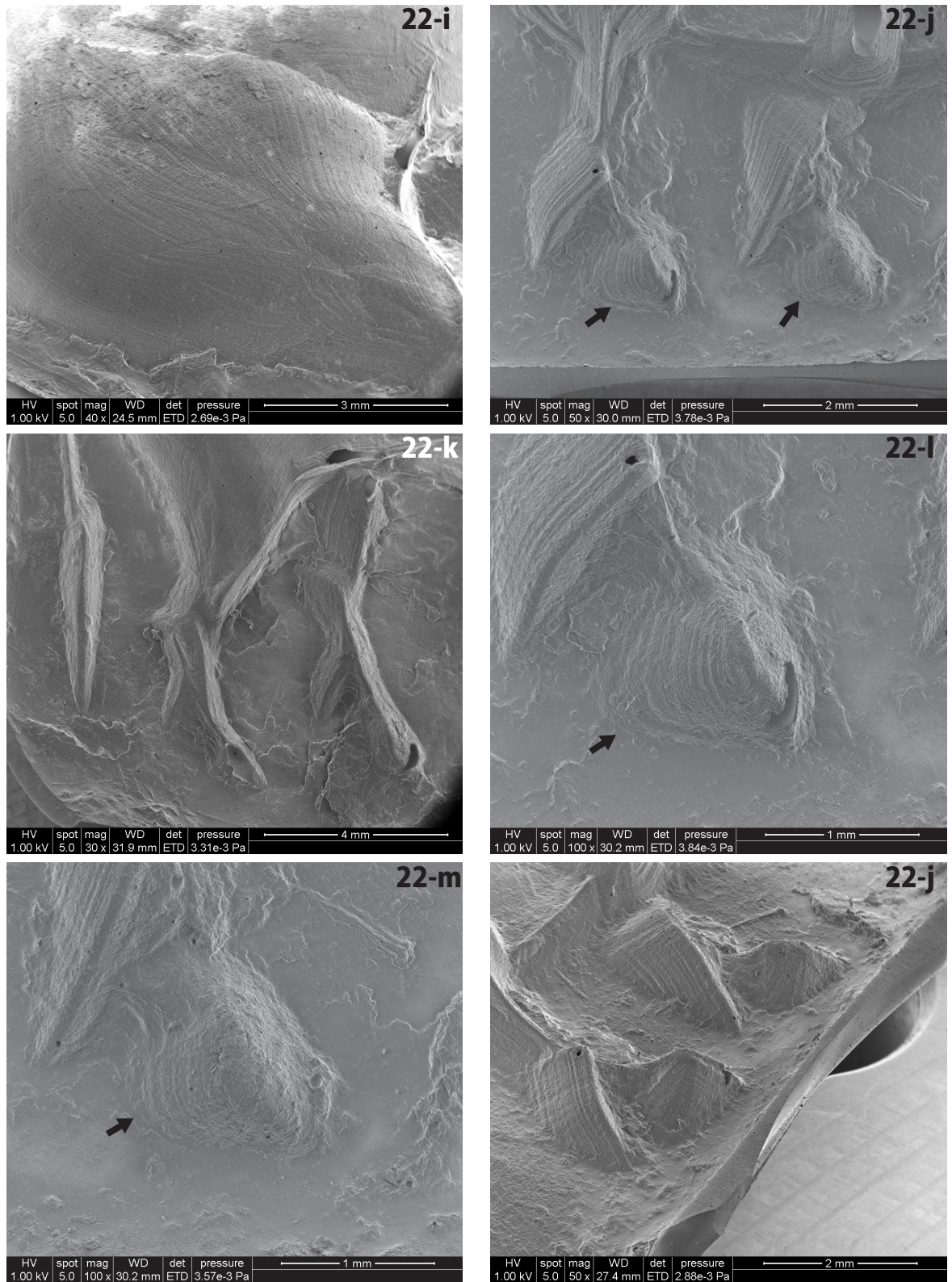


Figure 6.98: SEM images of Harappan seal discovered from Mohenjodaro

Chapter 7

Discussion and Conclusions

Chapter 7 - Discussion and Conclusions

Chapter introduction

In this last chapter, a concluding discussion about the diversity of the Harappan Civilization, based on the various discussions of Harappan seals in this dissertation, will be given. This study leads to an important conclusion - Namely that the Ghaggar Basin was a crucial region of this Civilization and had a specific feature as part of the diversity of the Harappan Civilization.

1. Regional variation or diversity of the Harappan seals

The Harappan seals can be divided into two types based on their design, namely Type A seal and Type B seal. Specific features of both types are as follows;

Type A seal: the Harappan seal is characterized by a left-facing animal motif, arrangement Pattern I and type I boss,

Type B seal: the Harappan seal is characterized by a right-facing animal motif, arrangement Pattern II or III and type II boss mainly.

As far as distribution pattern is concerned, although some Type B seals are reported from other regions such as Sindh (e.g. Mohenjodaro), Punjab (e.g. Harappa) and Gujarat (e.g. Dholavira), etc., it is clear from the analysis in Chapter 5 that Type B seals are concentrated mainly in the Ghaggar Basin. On the other hand, Type A seals are preferential in other regions, excluding the Ghaggar Basin.

As the analyses through SEM and 3D images in Chapter 6 describe, the sections of the animal's body have a different shape in each seal type, namely Type A seals have a concave section, while on the other hand, Type B seals have a squarish section (some seals have a concave-squarish section). In connection with this point, it can be

mentioned that both section types of the animal's body in both seal types are a result of the different manufacture techniques and tools.

It can be seen from specific distribution patterns and different manufacture techniques of both seal types, that Type B seals which are reported from Sindh, Punjab and Gujarat, etc. ranged from the Ghaggar basin to those regions, on the other hand, Type A seals which are reported from the Ghaggar basin are reported from Sindh (Mohenjodaro) and Punjab (Harappa).

The results of this study lead to an important conclusion- that the Harappan seals having a right-facing animal, namely Type B seals, are very likely to show the regional variation or diversity of Harappan seals.

2. Diversity of Harappan Civilization

In this dissertation, the Harappan seals in a full sense to understand a part of diversity of the Harappan Civilization, especially in the Ghaggar Basin, are discussed.

Type B seals, which are concentrated in the Ghaggar Basin, reflect the regional variation or diversity of the material culture of the Harappan Civilization, as well as regional differences in the ceramic assemblages of the Harappan sites like Farmana in the Ghaggar Basin (such as continuity of the Sothi-Siswal ceramic tradition even in the Harappan phase along with the Harappan pottery) (Figure 7.1).

In the centre of the Harappan Civilization, namely the Sindh region, the classical Harappan material culture is mainly found. Examples of the ceramic assemblage likewise comprise mainly of Harappan pottery. This situation of the material culture is different from that of the Ghaggar Basin. In connection with this study, the difference in the Harappan seals is recognized as one of the representative artifacts of the Harappan culture.

According to the special functions and significance of the Harappan seals, it can be pointed out that the Harappan seal is the most important indicator of socio-

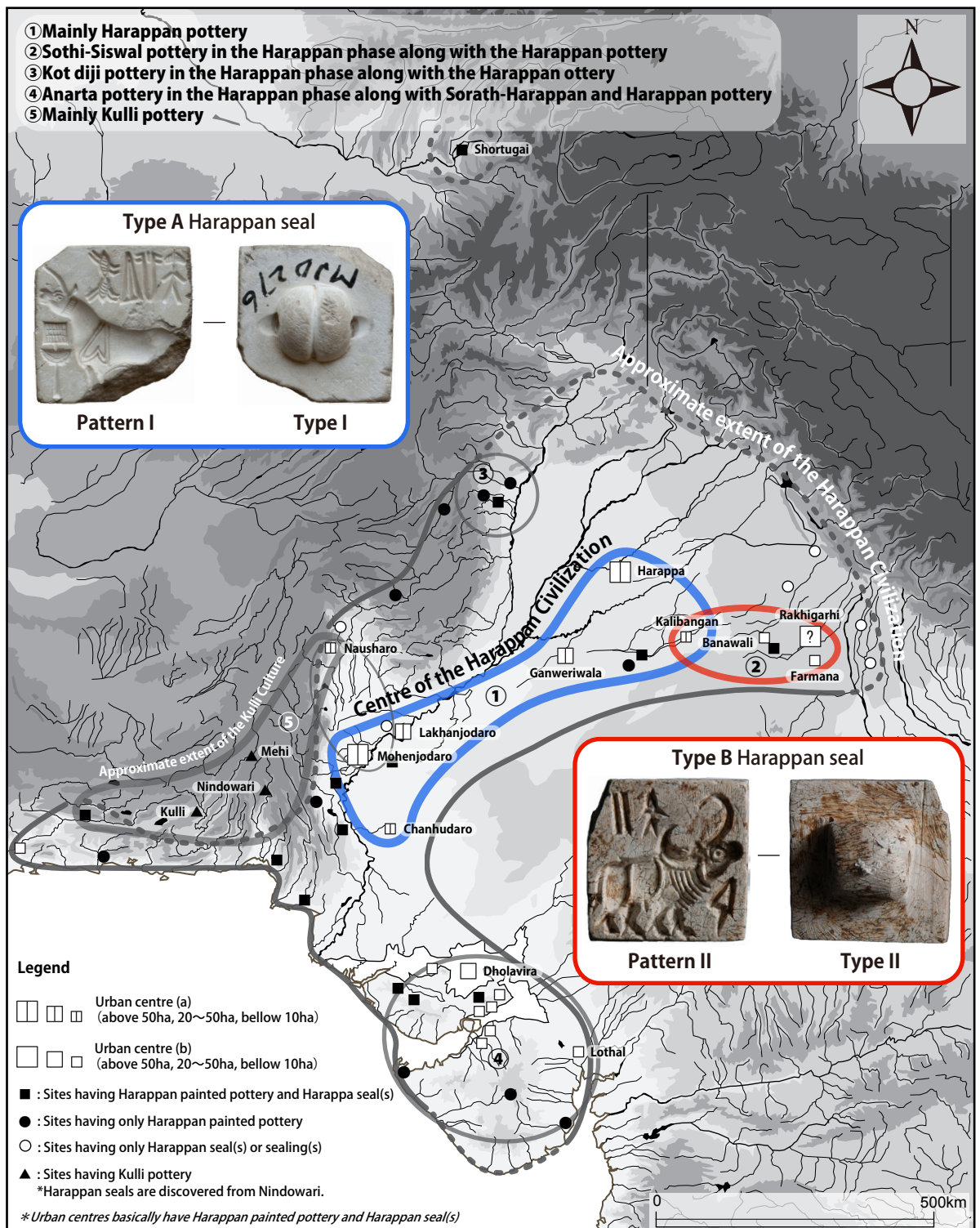


Figure 7.1: Conceptual image about the diversity of Harappan Civilization

economical aspect of the Harappan Civilization. For this reason, as a main concluding remark of the present study, it is emphasized that this regional variation or diversity of the Harappan seals reflects a part of diversity of Harappan Civilization, especially in the Ghaggar Basin.

As is indicated by the conclusion in this study, it is most likely that the structure of the Harappan Civilization involves social/cultural diversity.

The next subject to be discussed from an archaeological perspective is the meaning of diversity of Harappan Civilization. To understand the meaning of diversity of Harappan Civilization, we have to take a synthetic archaeological study on the material culture in this Civilization.

Concluding remarks

Because of this research, the following aspects have been understood:

- 1) Various aspects of the seals in the Pre-/Early Harappan period (Chapter 3),
- 2) Size categorization of the Harappan seals (Chapter 4),
- 3) Design of the Harappan seals (Chapter 5),
- 4) Manufacture techniques of the seals in the Pre-/Early Harappan period and Harappan seals (Chapter 6),
- 5) Regional variation or diversity of the Harappan seals (Chapters 5 and 6),
- 6) Diversity of the Harappan Civilization in the Ghaggar Basin with special reference to the Harappan seals (Chapter 7).

Future directions

There are four future directions of research from the present study, which are listed as follows:

- 1) To take a synthetic study of the Harappan seals, that is based on an actual observation of all seals, to reappraise the results of this study,

- 2)** To discuss the typological changes of the Harappan seals, based on the seals found in the relevant archaeological context, from new and future excavations,
- 3)** To accumulate the SEM and 3D data of the Harappan seals for understanding the manufacture techniques of them in a full sense,
- 4)** To undertake a study of the Harappan seals, based on an experimental archaeological study, to understand and reconstruct the manufacture techniques of them in a full sense,
- 5)** To undertake a geological provenance study to understand the provenance of steatite for making Type A seals and Type B seals respectively,
- 6)** To undertake a synthetic study of the material culture of the Harappan Civilization to understand the meaning of ‘socio/cultural diversity’ of this Civilization.

Appendices

Appendix 1.1 Table 1.1: Chronology of Harappan tradition and neighbors (1)

Indus Valley Tradition			Mesopotamia	Iran				Southern Turbhenia			Bactria & Margiana	Afghanistan		Persian Gulf	Kechi-Makran																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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ED: Early Dynastic DMG: Der Morasi Ghundai BMAC: Bactria Margiana Archaeological Complex

Appendix 1.2 Table 1.2: Chronology of Harappan tradition and neighbors (2)

Indus Valley Tradition			Khadar, Aravan, Kamrakh		Karot		Qattā		Kachi		Zhob-Lorari								
Age	Era	Stage	Phase	C14 date (calibrated years)	Kulli & Mehri	Nal	Aujira	Siāh Damb	KGM	Damb Sadaat	Mehargarh	Nausharo	Pirak	Rana Ghundai	Perano Ghundai	Sur Jangal			
Bronze / Copper	Localization Era	7	Pirak Phase	1500BCE									IB						
			Late Harappan Phase	1800BCE	Mehi (BMAC)							VIII		IA					
		Integration Era	6	Kulli Phase (Harappan Phase)	2000BCE	III							IV						
	Harappan Phase (Kulli Phase ?)			2300BCE	Kulli							III							
				?	II							II		?					
	Chalcolithic	Regionalization Era	5	Early-Mature Harappan Transition	2600BCE		III												
4			Kot Dijian Phase	3000BCE	I		?					C VII B A	D		IIIc	I (upper)			
			Gomal Phase			V	III		II			IIIb							
			Sothi-Siswal Phase			IV	II iii			VI									
			Amri-Nal Phase						V										
3			Qatta Phase							I					IIIa				
			Nal Phase			II													
			Tochi-Gomal Phase									IV							
			Kachi Beg Phase								ii			IV					
			Hakra Phase (Ravi Phase)			I	III	ii i				III							
Ceramic Neolithic / Chalcolithic	Early Food Producing Era	2	Togau Phase	4000BCE															
			Sheri Khan Tarakai Phase				II	I	III										
			Kili Ghul Mohammad Phase	4500BCE							II				Ib				
		1	Emergence Phase of pottery	5000BCE			I			II					Ia				
										I					?				
Acramitic Neolithic	Early Food Producing Era	0	Mehargarh I	5500BCE															
				6000BCE															

KGM: Kili Ghul Muhammad

Appendix 1.3 Table 1.3: Chronology of Harappan tradition and neighbors (3)

Indus Valley Tradition			C14 date (calibrated years)		Sindh			Bannu		Gomal			North-western and Western Punjab						
Age	Era	Stage	Phase	Bala kot	Amri	Mohenjodaro	Kotdiji	Chanhudaro	Lewan	SKT	Gumla	Rahman Dheri	Jhandi Batar A & B	GUK North & South	Maru I & II	Sarai Khora	Harappa	Jalilpur	
Bronze / Copper	Localization Era	7	Pink Phase Late Harappan Phase Cemetery H Phase Jhukal Phase		IIID	Jhukal		Jhukal							<II>		5		
			Kulli Phase (Harappan Phase)		IIIC	B (late)		Ic								?	?	4	
	Integration Era	6	Harappan Phase (Kulli Phase ?)		IIIB	B		Ib									3C		
			II	IIIA	A	L2-1	Ia			IV (upper)				<I>				3B	
Chalcolithic	Regionalization Era	5	Early-Mature Harappan Transition		IIA/B ID	early ?	L4-3 L7-5		Late		IV	IIIB	?		?	?	2		
		4	Kot Dijian Phase Gomal Phase Sohi-Siswal Phase Amri-Nal Phase Quetta Phase						Middle		III	IIIA	?					1B	
				I	IC		L16-8 ?			Early ?	?	II	IB	?		?			
			3	Nal Phase Tochi-Gomal Phase Keshi Beg Phase Hakra Phase (Ravi Phase)		IB IA							I	IA					1A
Ceramic Neolithic / Chalcolithic	Early Food Producing Era	2	Togau Phase Sheri Khan Tarakai Phase								?				<South>				
			Kili Ghul Mohammad Phase																
		1	Emergence Phase of pottery																
Aceramic Neolithic	0	Mehgarh I																	
*C14 Chronology in Harappa (Meadow and Kenoyer 2005) Period 1: Ravi Phase c. 3300(?)–2800(?)BC Period 2: Kot Diji Phase (Early Harappa) c. 2800(?)–2600/2500BC Period 3A: Harappa A c. 2600/2500–2450/2400BC Period 3B: Harappa B c. 2450/2400–2200BC Period 3C: Harappa C c. 2200–1900BC Period 4: Transitional c.1900–1800(?)BC Period 5: Late Harappa c.1800(?)–<1500BC																			

SKT: Sheri Khan Tarakai GUK: Ghandi Umar Khan

Appendix 1.4 Table 1.4: Chronology of Harappan tradition and neighbors (4)

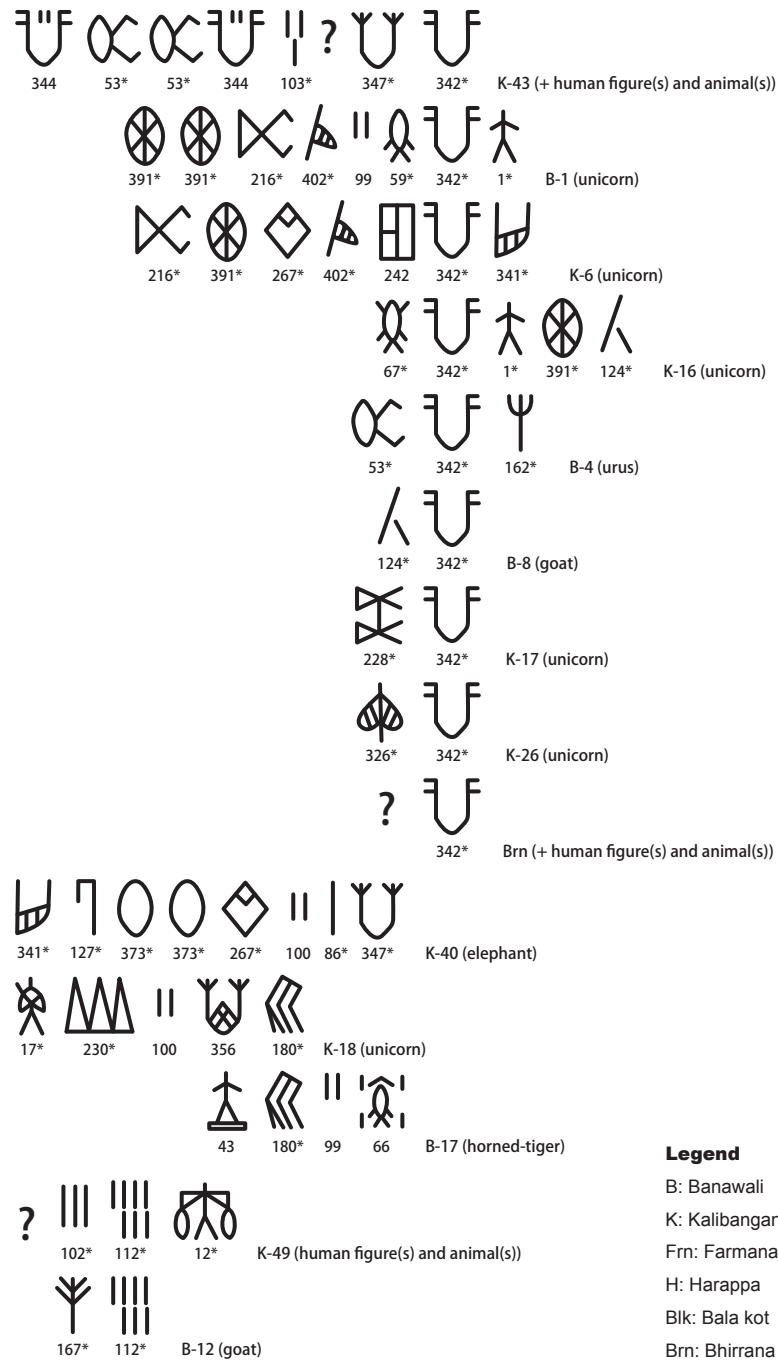
Indus Valley Tradition			C14 date (calibrated years)	Northern Rajasthan and Haryana								Gujarat					Central India				
Age	Era	Stage		Phase	Kalibangan	Banawali	Rakhigarhi	Bhirrana	Kunal	Famana	Gravadd	Mithatal	Dholavira	Surkotada	Kanmer	Lothal	Rangpur	Other sites	Ahar	Balathal	Gilund
Bronze / Copper	Localization Era	7	Prak Phase Late Harappan Phase Cemetery H Phase Juhai Phase	1500BCE									VII				III		Malwa		
			1800BCE																		
	Integration Era	6	Kulfi Phase (Harappan Phase)	2000BCE	III		?				IIB	VI	IC	III IIB	B	IIC					
			Harappan Phase (Kulfi Phase ?)	2300BCE				IIB				IIA	V	IB	IIA	A	IIB				
				2600BCE	II	II	II	IIA		II		I	III II		I			IIA			
	Chalcolithic	Regionalization Era	5	Early-Mature Harappan Transition																	Phase A
4			Kot Dijian Phase Gomal Phase Sothi-Siswal Phase Amri-Nal Phase Quetta Phase	3000BCE	I	I	Ib	IB	Ic	I ?			I				I ?	Motippli			
			3	Nal Phase Techi-Gomal Phase Kechi Beg Phase Hakra Phase (Ravi Phase)	3500BCE			Ia	IA	Ib		Girawad ?									
Early Food Producing Era		2	Togau Phase Sheri Khan Tarakai Phase	4000BCE																Lotesghwar	
			Ceramic Neolithic / Chalcolithic	1	Kili Ghul Mohammad Phase	4500BCE															
					Emergence Phase of pottery	5000BCE															
Aceramic Neolithic		0	Mehargarh I	6000BCE																	

Appendix 4.1 Table 4.4: Catalogue of basic data of the exceptional Harappan seals without a staff or a manger

CISI No.	Site	Motif	Object in front of animal	Pattern of motifs arrangement	Direction of head of animal	Crosswise (mm) > X	Lengthwise (mm) > Y	Thickness excluding boss (mm)	Thickness including boss (mm)	Type of boss	Feature of inscription (Mahadevan 1977)	Material	Remarks	Source
M-72	Mohenjodaro	Unicorn	without staff	I	Left	31.5	30.5	6.0	14.0	I	267, 99, 102, 17, 336, 51, 342	Fired steatite	coarse depicted (unfinished?)	CISI Vol. 1
M-223	Mohenjodaro	Unicorn	script instead of staff	II	Right	22.3	21.5	—	—	—	342, 385, 162	Fired steatite		CISI Vol. 1
M-955	Mohenjodaro	Unicorn	without Staff ?	I	Right	18.5	18.5	—	—	—	102, 216, 123	Fired steatite		CISI Vol. 2
M-1718	Mohenjodaro	Unicorn	script instead of staff	II	Left	33.5	36.0	—	—	—	99, 391, 342, 121, 397	Fired steatite		CISI Vol. 3.1
M-1719	Mohenjodaro	Unicorn	script instead of staff	II	Left	31.0	31.5	—	—	—	67, 244, 342, 242	Fired steatite		CISI Vol. 3.1
M-1792	Mohenjodaro	Unicorn	script instead of staff	II	Left	29.5	29.5	—	—	—	342, 82, 342, 67, 347, 342	Fired steatite		CISI Vol. 3.1
M-1793	Mohenjodaro	Unicorn	with Staff ?	I	Left	27.5	27.5	—	—	—	60, 97, 87, 123, 305	Fired steatite	only impression	CISI Vol. 3.1
M-1855	Mohenjodaro	Unicorn	without staff	I	Right	12.5	13.5	—	—	—	?, ?	Fired steatite	only impression	CISI Vol. 3.1
M-1856	Mohenjodaro	Unicorn	without staff	I	Left	13.0	13.5	—	—	—	?, ?	Fired steatite	only impression	CISI Vol. 3.1
M-1857	Mohenjodaro	Unicorn	without staff	I	Left	10.5	11.0	—	—	—	102, 162	Fired steatite		CISI Vol. 3.1
H-73	Harappa	Unicorn	without staff	I	Right	22.0	21.5	—	—	—	70, 12	Fired steatite		CISI Vol. 1
C-1	Chanhudaro	Unicorn	without staff	I	Left	52.5	50.0	—	—	I	104, 302, 402, 99, 9, 8, 342, 7, 403, 86	Fired steatite	very coarse depicted engraved-unfinished?	CISI Vol. 1
C-17	Chanhudaro	Unicorn	human figure instead of staff	II	Right	21.0	20.5	—	—	—	8, 342, 1	Fired steatite		CISI Vol. 1
K-3	Kalibangan	Unicorn	without staff	I	Right	37.0	35.0	10.0	—	broken	—	terracotta?	very coarse depicted	CISI Vol. 1
K-26	Kalibangan	Unicorn	script instead of staff	II	Right	29.0	29.0	—	—	—	326, 342	Fired steatite		CISI Vol. 1
B-3	Banawali	Unicorn	script instead of staff	II	Right	14.8	14.8	—	—	—	105, 59, 211	Fired steatite		CISI Vol. 1
—	Farmana	Unicorn	script instead of staff	II	Right	21.3	21.0	4.3	12.5	II	67, 59, 211	Fired steatite		Konasukawa et al. 2011
—	Bhirrana	unicorn	script instead of staff	I	Right	22.5	21.5	5.0	9.0	II	253, 230, 211	Fired steatite		Kumar and Dangi 2006
—	Miri Qalat	Unicorn	script instead of staff	II	Left	28.0	28.0	—	—	—	342, 342, 342	Fired steatite	Period IV	Besenal 1994
K-27	Kalibangan	Urus	without staff	II	Right	15.0	14.5	—	—	II	267, 99	Fired steatite		CISI Vol. 1
K-28	Kalibangan	Bison	without manger	I	Left	25.5	25.5	—	—	—	205, 305, 99, 192, 342, 167, 123,	Fired steatite		CISI Vol. 1
—	Dholavira	Bison (Antelope ?)	without manger	III	Right	30.0	30.0	7.0	—	—	—	Fired steatite		NHK and NHK Promotions 2000
M-269	Mohenjodaro	Buffalo	without manger	I	Right	22.8	22.3	—	—	—	204, 245, 342	Fired steatite		CISI Vol. 1
M-270	Mohenjodaro	Buffalo	without manger	III	Right	22.0	23.5	4.0	10.5	II	?	Fired steatite		CISI Vol. 1
B-7	Banawali	Buffalo	without manger	I	Right	22.8	21.8	3.5	7.2	II	267, 99	Fired steatite		CISI Vol. 1
—	Farmana	Buffalo	script instead of manger	II	Right	20.0	20.0	6.0	11.5	II	87, 59, 211	Fired steatite		Konasukawa et al. 2011
M-1134	Mohenjodaro	Rhinoceros	without manger	I	Right	38.0	37.5	—	—	I	391, 252, 381?, 219	Fired steatite		CISI Vol. 2
M-1908	Mohenjodaro	Rhinoceros	script (?) instead of staff	II	Left	25.0	25.0	—	—	—	347, 342, 86?	Fired steatite		CISI Vol. 3.1
M-1909	Mohenjodaro	Rhinoceros	without manger	I	Left	25.0	25.0	—	—	—	233, 249, 99, 106, 402	Fired steatite		CISI Vol. 3.1
M-1911	Mohenjodaro	Rhinoceros	without manger	I	Right	18.0	18.0	—	—	—	391, 99, 228, 162, 242	Fired steatite	only impression	CISI Vol. 3.1
B-15	Banawali	Rhinoceros	without manger	I	Right	19.0	19.0	6.5	11.8	II	267, 99	Fired steatite		CISI Vol. 1
—	Shortugai	Rhinoceros	without manger	I	Left	16.8	17.6	—	0.9	II	102, 190	Fired steatite		Francfort 1989
M-291	Mohenjodaro	Tiger ?	without manger	I	Left	34.0	33.0	—	—	broken	303, 304, 342	Fired steatite	very coarsely depicted	CISI Vol. 1

Appendix 4.2 Table 4.5: Catalogue of basic data of the exceptional Harappan seals with a staff or a manger

CISI No.	Site	Motif	Object in front of animal	Pattern of motifs arrangement	Direction of head of main animal motif	Crosswise (mm)→X	Lengthwise (mm)→Y	Thickness excluding boss (mm)	Thickness including boss (mm)	Type of boss	Feature of inscription (Mahadevan 1977)	Material	Remarks	Source
L-48	Lothal	Goat	with staff	II	Left	28.5	27.8	—	—	—	162, 343, 100, 60, 141, 272	Fired steatite		CISI Vol. 1
M-1135	Mohenjodaro	Rhinceros	with staff	I	Left	33.5	32.5	—	—	—	330, 176, 99, 124, 342	Fired steatite		CISI Vol. 2
K-39	Kalibangan	Rhinceros	with staff (flag ?)	I	Left	18.5	18.5	3.0	11.0	broken	249, 162	Fired steatite	only impression	CISI Vol. 1
M-1152	Mohenjodaro	Elephant	with manger	I	Left	30.5	30.5	—	—	—	267, 99, 59, 403, 87, 342	Fired steatite		CISI Vol. 2
B-17	Banawali	Horned tiger	with staff	I	Right	30.5	29.5	7.9	17.8	I	43, 180, 99, 66	Fired steatite		CISI Vol. 1
—	Bhirrana	Horned deity-???	with manger	III	Left	41.0	41.0	—	—	—	—	Fired steatite		Rao et al. 2005



Appendix 5.1 Figure 1.1: Harappan scripts on a seal having a right-facing animal (Ghaggar Basin)



Appendix 5.2 Figure 1.2: Harappan scripts on a seal having a right-facing animal (Other regions excluding Ghaggar Basin)

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